CONNECTICUT RIVER FLOOD CONTROL PROJECT

CHICOPEE, MASS.

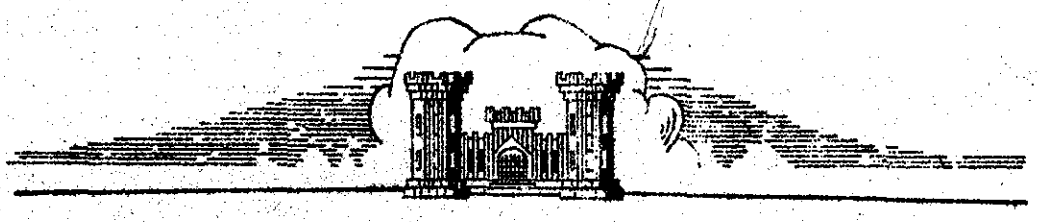
CONNECTICUT RIVER, MASSACHUSETTS

SPECIFICATIONS

FOR

JONES FERRY PUMPING STATION

ITEM C.5c - CONTRACT



1940

CORPS OF ENGINEERS, U.S. ARMY

U.S. ENGINEER OFFICE PROVIDENCE, R.I.

CONNECTICUT RIVER FLOOD CONTROL PROJECT

SPECIFICATIONS

FOR CONSTRUCTION OF

JONES FERRY PUMPING STATION

ITEM C.5c (CONTRACT)

CHICOPEE, MASSACHUSETTS

MARCH 20, 1940

(ISSUED MAY 7, 1940)

CORPS OF ENGINEERS, U. S. ARMY

U. S. ENGINEER OFFICE PROVIDENCE, R. I.

No. Bidder Invitation No. 699-40-323
(Do not write above this line)

STANDARD GOVERNMENT FORM OF INVITATION FOR BIDS
(Construction Contract)

War Department
United States Engineer Office
Providence, R. I.
May 7, 1940.

SEALED BIDS, in duplicate, subject to the conditions contained herein, will be received until 2:00 p.m., Eastern Daylight Saving Time, June 6, 1940, and then publicly opened, for furnishing all plant, labor, and materials, except the equipment to be furnished by the Government as provided in the specifications, and performing all work for the construction of the Jones Ferry Pumping Station, located on the east bank of the Connecticut River in Chicopee, Massachusetts.

I. THE WORK shall be in strict accordance with the specifications, bidding schedule, and drawings, designated as follows:

Specifications for construction of Jones Ferry Pumping Station at Chicopee, Massachusetts.

The drawings which will become a part of this contract are designated in Paragraph 1-04 of the specifications. Where copies of drawings are requested, a deposit of $10.00 will be required to insure their return. This deposit should be in the form of a United States money order or a certified check, made payable to "The Disbursing Officer, U. S. Engineer Office, Providence, Rhode Island." The $10.00 deposit for each complete set of drawings will be refunded upon return of said drawings in good condition within 60 days after date of opening bids.

II. GUARANTEE will be required with each bid as follows: Bid bond, Standard Form No. 24, will be executed in a penal sum approximately equal to and not less than ten (10) percent of the total amount of the bid. Individual sureties will justify in sums aggregating not less than double the penalty of the bid bond. (See Paragraphs 8 to 11, inclusive, of Instructions to Bidders). Certified check may be furnished in lieu of bid bond.

III. PERFORMANCE AND PAYMENT BONDS will be required from the successful bidder as follows:

a. A performance bond with good and sufficient surety or

sureties, for the protection of the United States, Standard Form No. 25 will be executed in a penal sum approximately equal to and not less than fifty (50) percent of the full amount of the consideration of the contract.

b. If the consideration of the contract will exceed $2,000.00 in amount, a payment bond with good and sufficient surety or sureties, for the protection of persons furnishing material and labor for the work, Standard Form No. 25-A, will be executed in a penal sum equal to fifty (50) percent of the full amount of the consideration of the contract when the latter is not more than one million dollars ($1,000,000.00); forty (40) percent where the contract exceeds one million dollars ($1,000,000.00) but is not more than five million dollars (5,000,000.00); and two million five hundred thousand dollars ($2,500,000.00) for all contracts above five million dollars ($5,000,000.00)

IV. LIQUIDATED DAMAGES for delay will be prescribed. (See Paragraph 1-07 c of the specifications.)

V. TAX ADJUSTMENTS. - Provisions for tax adjustments will be made a part of the contract. (See Paragraph 1-12 of the specifications.)

VI. PARTIAL PAYMENTS will be made. (See Article 16 of the contract and Paragraph 1-10 of the specifications.)

VII. ARTICLES ON PATENTS will be made a part of the contract. (See Paragraph 1-17 of the specifications.)

VIII. BID AND CONTRACT. - a. Bids must be submitted upon the Standard Government Form of Bid and the successful bidder will be required to execute the Standard Government Form of Contract for construction. The bid form has an entry for each item on which estimates will be given or payments made, and no other allowances of any kind will be made unless specifically provided for in the specifications or the contract, or adjustments under Article 3 of the contract. Bids shall be for the entire work and shall have each blank filled.

b. The quantities of each item of the bid, as finally ascertained at the close of the contract, in the units given and the unit prices of the several items stated by the bidder in the accepted bid, will determine the total payments to accrue under the contract. The unit price bid for each item must allow for all collateral or indirect cost connected with it.

c. The successful bidder will be required to return the contract duly executed and to furnish the performance and payment bonds hereinbefore described, within ten (10) days after the papers are presented to him.

IX. EXPERIENCE. - a. Each bidder shall state in his bid whether he is now or ever has been engaged on any contract or other work similar

to that proposed, giving the year in which it was done and the manner of its execution, and shall submit such other information as will tend to show his ability to prosecute vigorously the work required by these specifications.

b. The successful bidder will be required to employ an organization thoroughly experienced and skilled in the manufacture, fabrication, and installation of the crane, lighting system, and other equipment that is to be furnished and installed in the pumping station. After the opening of bids, any bidder may be required to submit satisfactory evidence that the specific organizations which he proposes to employ on this portion of the contract have successfully executed work of the nature and quality indicated above.

X. COMMENCEMENT AND COMPLETION. - Work shall be commenced within ten (10) calendar days after receipt of notice to proceed and shall be completed within 250 calendar days, in accordance with the provisions of Paragraph 1-07 of the specifications.

XI. MINIMUM WAGE RATES for the locality of the work have been determined by the U. S. Department of Labor, and proof of payment of such wages will be required. (See Articles 17 and 19 of the contract and Paragraph 1-35 of the specifications.)

XII. EIGHT-HOUR LAW. - The requirements of the Eight-Hour Law, Article II of the contract, will be applicable to the work under the contract.

XIII. ARTICLES ON PREFERENCE for domestic materials will be made a part of the contract. (See Article 18 of the contract and Paragraph 1-31 of the specifications.)

XIV. REPORTS TO THE DEPARTMENT OF LABOR. - In order to assist the Department of Labor in obtaining employment statistics, bidders, unless otherwise indicated in their bids, will be considered as having voluntarily consented, without cost to the Government, to the inclusion of Paragraph 1-36 of the specifications as a part of the contract.

XV. INVESTIGATION OF CONDITIONS. - Bidders are expected to visit the locality of the work and acquaint themselves with all available information concerning the nature of the materials that will be encountered, the depths to which it may be necessary to excavate in order to secure satisfactory foundations, and the local conditions bearing on the work. They are also expected to make their own estimates of the facilities needed, and the difficulties attending the execution of the proposed contract, including local conditions, availability of labor, uncertainties of weather, and any other contingencies. In no event will the Government assume any responsibility whatever for any interpretation, deduction, or conclusion drawn from the examination of the site. At the bidder's request, a representative of the Government will point out the site of the proposed operations. Failure to acquaint himself with all available in-

formation concerning these conditions will not relieve the successful bidder of assuming all responsibility for estimating the difficulties and costs of successfully performing the complete work.

XVI. FACILITIES AVAILABLE FOR CONSTRUCTION are described in Paragraph 1-06 of the specifications.

XVII. DATA TO BE SUBMITTED WITH BIDS. - a. Each bidder shall submit with his bid, drawings showing proposed plant layout and charts showing the rate of progress the bidder will maintain on the work, carefully prepared and presented in neat and legible form. These data are considered essential in assisting the contracting officer to determine whether or not the bidder is responsible, experienced in similar types of construction, and that his bid is based on a careful study of construction methods applicable to the work, and prepared with a full realization of the various factors which may affect its progress.

b. The drawings indicating the plant layout shall clearly show the location and manner of employment of the various major items of plant, the method of excavation and disposal of materials, and the manner in which structural features will be erected.

c. The progress charts shall indicate the volume of work to be done and the rate of progress which the bidder agrees to maintain for each of the following major operations required in the performance of the work under these specifications: Excavation, Concreting, Earth Embankment, and Pumping Station. These charts may be in any convenient form in which the time element shall be plotted to represent definite intervals of time measured from date of notice to proceed with the work, and the volume of work shall be represented by a suitable scale of percentage of completion based on the estimated contract quantities. Careful consideration shall be given to the preparation of the charts, as the contractor will be required to maintain the rate of progress indicated thereon.

XVIII. PLANT. - Each bidder shall state in his bid the character and amount of plant that he proposes to employ on the work. After bids are opened any bidder may be required to show that he owns, controls, or can procure the plant necessary for commencing, prosecuting, and completing the work as required by the specifications.

XIX. AWARD OF CONTRACT. - a. Subject to the rights hereinafter reserved, the work will be awarded as a whole to one bidder. The right is reserved as the interest of the Government may require, to reject any and all bids, and to waive any informality in bids received.

b. A bid may be rejected if the bidder cannot show that he has the necessary capital and experience, and owns, controls by firm option or can procure the necessary plant to commence the work at the time prescribed in the specifications and thereafter to prosecute and complete the work at the rate or time specified; and that he is not al-

ready obligated for the performance of other work which would delay the commencement, prosecution or completion of the work contemplated in this advertisement.

c. Any unbalanced bid, which in the opinion of the contracting officer, jeopardizes the interest of the Government, will be subject to rejection for that reason.

XX. ADDRESS FOR BIDS. - Bids submitted must be in envelopes with sufficient postage, sealed, marked and addressed as follows:

(Marked in upper left-hand corner)

Bid for construction of Jones Ferry Pumping Station and Appurtenant Structures on the Connecticut River, Chicopee, Mass.

To be opened June 6, 1940.

(Addressed to)

The District Engineer,
U. S. Engineer Office,
819 Industrial Trust Bldg.,
Providence, R. I.

NOTE: - See Standard Government Instructions to bidders and copy of the Standard Government Forms of contract, bid bond, payment bond, and performance bond, which may be obtained upon application.

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SECTION I. GENERAL PROVISIONS

DETAILED SPECIFICATIONS

Invitation No. 699-40-323

WAR DEPARTMENT
UNITED STATES ENGINEER OFFICE
PROVIDENCE, R. I.

APPROPRIATION: 21X3113 FLOOD CONTROL, GENERAL

Item C.5c (Contract)

JONES FERRY PUMPING STATION AT CHICOPEE, MASSACHUSETTS.

S P E C I F I C A T I O N S

SECTION I. GENERAL PROVISIONS

1-01. Location. - The site of the work covered by these specifications is located on the east bank of the Connecticut River, in the north portion of the City of Chicopee, Massachusetts.

1-02. Work to be done. - a. The work provided for herein is authorized by the Flood Control Act of June 28, 1938 (Public No. 761, 75th Congress).

b. The work to be done consists of furnishing all plant, labor and materials, except equipment furnished by the Government (see Paragraph 1-14), and performing all work required for constructing a pumping station with conduit, and all appurtenant works, complete in accordance with these specifications, and the drawings forming a part hereof, together with such other incidental work at the site as may be required for completion of the work within the intent and scope of the specifications, or as may be ordered in writing by the contracting officer. It will consist of the following major items:

(1) Construction of a pumping station at traverse station 93+45.69, complete with conduit, and appurtenant structures.

(2) Installing major pumping station equipment, including pumps, piping and valves, gasoline engines, and right-angle gear units, all of which will be furnished by the Government.

(3) Furnishing and installing traveling crane, heating and ventilating equipment, electrical wiring and control equipment, and other auxiliary pumping station equipment.

1-03. Description of the work. - a. The pumping station will be located behind the Chicopee Dike near Jones Ferry Road in the north portion of the City of Chicopee, Massachusetts.

b. The pumping station will be built on an earth foundation. The pumping station substructure will be reinforced concrete. The conduit and appurtenant structures will be mainly of reinforced concrete. The pumping station superstructure will be built of structural steel with brick masonry walls and reinforced concrete roof slabs.

c. The contractor shall install in the pumping station three 42-inch pumping units driven by gasoline engines through right angle gear units, one 16-inch pump with electric motor, and gate valves and piping, all to be furnished by the Government. Provision shall be made for the future installation of an additional 42-inch pumping unit, including discharge wall pipe to be furnished by the Government. In addition to installing the aforesaid main pumping equipment furnished by the Government, the contractor shall furnish and install the following auxiliary equipment, including all accessories:

(1) Electric motor-driven sump pump.

(2) Fuel supply system for gasoline engines.

(3) One gasoline-electric standby unit.

(4) Electrical switchboard and control equipment.

(5) Carbon-dioxide fire extinguishing equipment.

(6) Steam boiler and heating system.

(7) Three sluice gates with operating equipment.

(8) 7-1/2 ton crane.

1-04. Drawings. - a. The work shall conform to drawings marked "Connecticut River Flood Control, Jones Ferry Pumping Station" as listed below, which drawings form a part of these specifications and are filed in the United States Engineer Office, Providence, Rhode Island.

LIST OF DRAWINGS

Sheet No.	Title	File No.
1	Project Location and Index	CT-4-2178
2	Stage Hydrograph No. 1	CT-3-1122
3	Stage Hydrograph No. 2	CT-3-1123
4	Subsurface Explorations	CT-2-1251
5	General Plan	CT-4-2179
6	Conduit and Intake Details	CT-4-2180
7	Outlet Gate Structure and Conduit Details	CT-4-2181
8	Outlet Gate Structure Bridge	CT-4-2182
9	Outlet Gate Structure and Conduit - Reinforcement No. 1	CT-4-2183

Sheet No.	Title	File No.
10	Outlet Gate Structure and Conduit - Reinforcement No. 2	CT-4-2184
11	Outlet Gate Structure and Conduit - Reinforcement No. 3	CT-4-2185
12	Outlet Gate Structure and Conduit - Reinforcement No. 4	CT-4-2186
13	Miscellaneous Details	CT-4-2187
14	Pump House Plans and Details	CT-4-2188
15	Pump House Elevations	CT-4-2189
16	Pump House Sections and Elevations	CT-4-2190
17	Pump House Door and Pilaster Details	CT-4-2191
18	Pump House Details	CT-4-2192
19	Roof Slab Steel Reinforcement	CT-4-2193
20	Operating Floor Details - No. 1	CT-4-2194
21	Operating Floor Details - No. 2	CT-4-2195
22	Base Slab - Reinforcement No. 1	CT-4-2196
23	Base Slab - Reinforcement No. 2	CT-4-2197
24	Sections and Details - No. 1	CT-4-2198
25	Sections and Details - No. 2	CT-4-2199
26	North Wall	CT-4-2200
27	South Wall	CT-4-2201
28	East and West Walls	CT-4-2202
29	Interior Walls and Boiler Room Floor	CT-4-2203
30	Intake Chamber and Conduit Roof Slab	CT-4-2204
31	Intake Chamber and Conduit Walls	CT-4-2205
32	Structural Steel Framing	CT-4-2206
33	Structural Steel Details	CT-4-2207
34	Miscellaneous Structural Steel Details - No. 1	CT-4-2208
35	Miscellaneous Structural Steel Details - No. 2	CT-4-2209
36	Miscellaneous Structural Steel Details - No. 3	CT-4-2210
37	Miscellaneous Structural Steel Details - No. 4	CT-4-2211
38	Trash Rack and Details	CT-4-2212
39	Gasoline Tank Support and Stairs to Wet Sump	CT-4-2213
40	General Arrangement of Equipment - No. 1	CT-4-2214
41	General Arrangement of Equipment - No. 2	CT-4-2215
42	General Arrangement of Equipment - No. 3	CT-4-2216
43	Plumbing and Heating - No. 1	CT-4-2217
44	Plumbing and Heating - No. 2	CT-4-2218
45	Plumbing and Heating - No. 3	CT-4-2219
46	Gasoline Piping - No. 1	CT-4-2220
47	Gasoline Piping - No. 2	CT-4-2221
48	Sluice Gates	CT-4-2222
49	Engine Exhaust Piping	CT-4-2223
50	Electric Light and Power System - No. 1	CT-4-2224
51	Electric Light and Power System - No. 2	CT-4-2225
52	Electric Light and Power System - No. 3	CT-4-2226

b. The work shall also conform to such other drawings relating thereto as may be exhibited in the office of the contracting of-

ficer prior to the opening of proposals, and to such drawings used in explanation of details as may be required from time to time during construction, including such minor modifications as the contracting officer may consider necessary on account of conditions discovered during the prosecution of the work.

c. Prior to performing the work, the contractor shall check all drawings and shall immediately report to the contracting officer any errors or omissions discovered therein. Quantities stated in bills of material on contract drawings are approximate, and the contractor shall furnish the required quantity without change in unit price. All items to be furnished at lump sum prices shall be provided by the contractor, complete and in good working order, regardless of whether or not they are fully shown or listed on the contract drawings. Parts and details not fully indicated on the drawings shall be detailed by the contractor in accordance with the best engineering practice, and four copies of each drawing shall be submitted to the contracting officer for approval. Each sheet of drawings submitted for approval shall be provided with a blank white space approximately 5 inches by 4 inches near the lower right-hand corner, just above the title, in which the contracting officer may indicate the action taken. After approval by the contracting officer, but before the work indicated on the contractor's drawings is commenced, one copy of each approved drawing will be furnished the contractor. These approved drawings shall form a part of the contract. The Government will not be responsible for minor errors or minor discrepancies of the contract drawings. Drawings furnished by the contractor for approval by the contracting officer shall be made with ink on tracing cloth. Upon completion of the project, the contracting officer shall be furnished with "Van Dyke" negatives of the contractor's drawings, corrected to show all revisions made during construction.

d. Ten sets of prints of all necessary drawings will be furnished without charge to the contractor upon request. Additional prints will be furnished upon request at the cost of printing.

1-05. Quantities. - The following estimate of quantities is given to serve as a basis for the comparison of bids and for determining the approximate amount of the consideration of the contract. Within the limits of available funds, the contractor will be required to complete the work specified in Paragraph 1-02, whether the required quantities are more or less than the amounts herein estimated, and final payment will not be made until the work is so completed.

Item	Designation	Unit	Quantity
1	Preparation of Site	acre	0.54
2	Control of Water and Sewage	job	-
3	Common Excavation - General	cu. yd.	11,500
4	Removal of Concrete Headwall	job	-
5	Removal and Replacement of Existing Sewers and Drains	"	-

Item	Designation	Unit	Quantity
6	Impervious Fill	cu. yd.	890
7	Pervious and Random Fill	" "	2,945
8	Gravel Bedding	" "	14
9	Semi-Compacted Backfill	" "	3,925
10	Compacted Backfill	" "	312
11	Riprap - Hand Placed	" "	27
12	36-Inch Reinforced Concrete Pipe	lin. ft.	25
13	24-Inch Reinforced Concrete Pipe	" "	122
14	Cement	bbl.	1,817
15	Concrete - Class "A"	cu. yd.	1,215
16	Concrete - Class "B"	" "	298
17	Steel Reinforcement	lb.	151,300
18	Pumping Station Superstructure	job	-
19	Miscellaneous Iron and Steel	lb.	22,981
20	Miscellaneous Pipe and Fittings	"	1,566
21	Copper Water Stops	"	357
22	Steel Trash Racks	job	-
23	Sluice Gates, Complete with Hoists	"	-
24	Heating and Ventilating Equipment	"	-
25	Lighting and Power System	"	-
26	Gasoline-Electric Standby Unit	"	-
27	Traveling Crane, Complete	"	-
28	Sump Pump	"	-
29	Water Supply and Plumbing Fixtures	"	-
30	Carbon Dioxide Fire Extinguishing Equipment	"	-
31	Emergency Water Supply System	"	-
32	Drains	"	-
33	Gasoline Tank and Piping	"	-
34	Float Gage	"	-
35	Installing Equipment Furnished by the Government	"	-
36	Topsoil	cu. yd.	235
37	Sodding and Seeding	acre	0.24
38	Surfacing for Top of Dike	cu. yd.	36
39	Manholes	each	2
40	Vitrified Clay Pipe	job	-

1-06. Physical data. - a. General. - Borings have been made in the vicinity of the proposed work with reasonable care and laboratory analyses have been made of the samples from some of these holes. Samples of materials taken from them, and records of laboratory analyses and results of other studies may be seen at the United States Engineer Office, Providence, Rhode Island. Samples and records available are believed to represent fairly the conditions at the site of the work, but it is expressly understood that the Government will not be responsible for any deduction, interpretation, or conclusions made by the contractor from his inspection of the available samples and records. These samples of materials represent all the pertinent information on subsurface exploration which the Government has made at the site. Concrete aggregates, riprap, and gravel

or crushed stone for bedding and drains, shall be obtained from approved sources.

b. Transportation facilities. - (1) Railroads. - The Boston and Maine Railroad serves the City of Chicopee with main and branch line traffic. The contractor shall investigate the availability of the sidings from the railroad company and make all arrangements with the latter for the use of any sidings for the delivery of any materials and equipment to be used on the work.

(2) Highways. - First-class highways also serve the city. The contractor shall provide for his own construction or access roads and their maintenance. He shall make his own investigation of available roads for transportation, or load limits for bridges and roads, and other road conditions affecting the transportation of materials and equipment to the site of the work.

c. Weather conditions. - The locality is subject to atmospheric temperatures ranging from minus 20 degrees to plus 105 degrees Fahrenheit. The mean annual precipitation at Chicopee is 43.62 inches. The mean monthly precipitation varies from a low of 3.20 inches in April to a high of 4.31 inches in July.

1-07. Commencement, prosecution, and completion. - a. The contractor will be required to commence the work under the contract within ten (10) calendar days after date of receipt by him of notice to proceed, to prosecute the said work with faithfulness and energy, and to complete the entire work, including the installation and testing of equipment in the pumping station (see Section XVIII), within 250 calendar days after said date of receipt of notice to proceed. The contractor shall construct the outlet gate structure including the installation of the sluice gate ready for operation, construct the concrete conduit and remove the 72-inch segmental block sewer within the dike limits and complete the dike work and such portions of the appurtenant work as is necessary to complete the closure of the flood protection work within 100 calendar days after said date of receipt of notice to proceed.

b. The contracting officer may, in his discretion, suspend work for the period during which sub-freezing temperatures are experienced or are reasonably to be expected, ground moisture conditions are unfavorable, or the water-surface in the river exceeds elevation of 52.0 feet (see Paragraph 3-01 b). The contractor will be required to resume operations on written notice from the contracting officer terminating the suspension, provided that a minimum of 3 days after receipt of notice will be allowed before it becomes effective. The time allowed for completion of the entire work is exclusive of any time that may intervene between the effective date of orders of the contracting officer to suspend operations and the effective date of orders to resume the work.

c. Liquidated damages. - (1) In case of failure on the part of the contractor to complete the work within the time determined and agreed upon for its completion plus any extensions duly granted under the terms of the contract, the contractor shall pay the Government as liquidated damages the following: For failure to complete the outlet gate structure including the installation of the sluice gate ready for operation, construct the

concrete conduit and remove the 72-inch segmental block sewer within the dike limits and complete the dike work and such portions of the appurtenant works as is necessary to complete the closure of the flood protection work within 100 calendar days after said date of receipt of notice to proceed, the sum of one hundred dollars ($100.00) for each calendar day of delay; and for delay in completing the entire work under the contract within 250 calendar days after said date of receipt of notice to proceed, the sum of fifty dollars ($50.00) for each calendar day of delay until all work is completed or accepted, except as otherwise specified in sub-paragraph (2) below.

(2) Minor deficiencies in the work, and operating deficiencies noted in tests on equipment, shall be corrected or adjusted within 30 calendar days after date of completion specified in sub-paragraph (1) above. The provision for liquidated damages shall not apply to the period of time, not exceeding 30 calendar days, allowed by the contracting officer to correct or adjust the aforesaid deficiencies, but final payment will not be made until such deficiencies have been satisfactorily corrected or adjusted.

1-08. Sundays, holidays, and nights. - No work shall be done on Sundays or on days declared by Congress as holidays for per diem employees of the Government except in cases of emergency, and then only with the written consent of the contracting officer. Work may be done at night when authorized in writing by the contracting officer.

1-09. Progress, organization, and plant. - a. The contractor shall employ at all times, an ample force of qualified workers, and provide equipment and a construction plant properly adapted to the work, and of sufficient capacity and efficiency to accomplish the work in a safe and workmanlike manner at the rate of progress stated in his bid and specified herein. All plant and equipment shall be maintained in good working order, and provisions shall be made for immediate emergency repairs. The contracting officer may order the removal and require replacement of any unsatisfactory plant or equipment. No reduction in the capacity of the plant employed on the work shall be made, except under written permission of the contracting officer. The measure of "Capacity of the Plant" shall be its actual performance on the work to which these specifications apply. It is understood that award of this contract shall not be construed as a guarantee by the Government that the plant and equipment listed by the contractor in the bid form is adequate for the performance of the work.

b. Should the contractor fail to maintain a rate of progress which will insure completion of the work within the time specified in Paragraph 1-07, the contracting officer may require that additional men, equipment or plant be placed on the work, or a reorganization of the plant layout be effected in order that the work be brought up to schedule and maintained there. Should the contractor refuse or neglect to comply with these requirements to the satisfaction of the contracting officer, the contracting officer will proceed under the provisions of Article 9 of the contract.

1-10. Payments. - Payments will be made monthly in accordance with Article 16 of the contract for work executed and completed as specified or otherwise required, and not included in any prior estimate, subject to the conditions stipulated in these specifications for estimating partial payments, except that 10 percent of the amount of each estimate will be retained until the full completion and acceptance of all work covered by the contract, when final payment will be made.

1-11. Work covered by contract price. - The contractor shall, under his contract prices, furnish and pay for all material, equipment, and labor, except the equipment and materials specified in Paragraph 1-14 and Section XVIII, and all permanent, temporary, and incidental work, furnish all accessories, and do everything that may be necessary to carry out the work specified in good faith, which contemplates everything specified completed, in good working order, of good materials with accurate workmanship, skillfully fitted and properly connected and put together (see Paragraph 1-13).

1-12. Tax adjustments. - The contract price will be considered to include all Federal, State and local taxes imposed prior to the date of opening bids and applicable to the undertaking. If any privilege, sales, gross receipt on other tax (exclusive of taxes on net income or undistributed profits) applicable to the undertaking and payable directly by the contractor, is imposed or changed after the date of opening bids by Federal or State enactment, then the contract price will be increased or decreased accordingly, and any amount due or chargeable against the contractor as a result thereof will be adjusted on payment vouchers as separate items.

1-13. Material to be furnished by the contractor. - a. The contractor shall furnish all materials and equipment, except as specified in Paragraph 1-14, necessary to complete the work to be done under these specifications. The equipment furnished by the contractor and installed in the work covered by these specifications shall conform to the drawings and specifications, and shall also conform to the drawings and data sheets furnished by the contractor and approved by the contracting officer. The cost of unloading and loading, handling, hauling, storing, and caring for materials and equipment furnished by the contractor shall be included in the contract prices for the work to which the materials and equipment pertain. All materials, supplies, and articles delivered at the site shall be adequately housed or otherwise protected against deterioration and damage (see Paragraph 18-03).

b. Each major piece of equipment furnished under the contract shall be provided with a substantial nameplate securely fastened in place and clearly inscribed with the manufacturer's name, year of manufacture, and the principal rating data.

1-14. Materials and equipment to be furnished by the Government. - a. The Government will furnish the following materials and equipment for the work under these specifications:

(1) Three 42-inch pumps.

(2) Three gasoline engines with mufflers and exhaust piping.

(3) Three right-angle gear units.

(4) One 16-inch pump with electric motor.

(5) Intake and discharge piping and valves for all pumps, including discharge wall pipe for future pump unit.

b. Delivery. - The contractor shall give the contracting officer 30 days' written notice of the quantities, designation, and desired delivery dates of materials and equipment required. (See Paragraph 18-02). The Government will not be liable for any expenses or delay caused the contractor by delayed deliveries, except as provided under Article 9 of the contract. The equipment and materials to be furnished by the Government will be delivered to the contractor f.o.b. railroad cars at Chicopee, Massachusetts, or f.o.b. trucks at the site of the work, at the option of the contracting officer.

1-15. Order of work. - The work shall be carried on at such places and also in such order of precedence as may be found necessary by the contracting officer. The contractor shall submit, for approval of the contracting officer, his proposed program in writing giving the sequence of construction operations contemplated. The location and limits of the work to be done will be plainly indicated by stakes, lines, marks or otherwise as established by the contracting officer or his agents.

1-16. Damage. - Damage to Government property due to the failure of the contractor to take reasonable precaution, and all loss or deterioration of, or damage to any of the work by flood, accident or exposure prior to final acceptance of the work, shall be made good by the contractor without expense to the Government, except that the Government will compensate the contractor for repairs to the permanent work, if damaged by flooding or scouring through no fault of the contractor (see Paragraph 3-01 b.

1-17. Patents. - The contractor shall hold and save the Government, its officers, agents, and employees harmless from liability of any nature or kind, including costs and expenses for or on account of any patented or unpatented process or invention, article, or appliance manufactured or used in the performance of this contract, including its use by the Government.

1-18. Grounds and right of way. - a. Grounds and right of way needed for the work to be done under these specifications will be furnished by the Government. The Government shall not be held liable for any delay in furnishing the grounds or right of way, but in case such delay retards the operations of the contract, the contracting officer will grant an extension of time for the completion of the work equal to the length of the delay (see Paragraph 1-07). The contractor will have the privilege of using the Government controlled land at the site, not otherwise reserved by the contracting officer; provided that plans for all construction, storage, or other operations proposed thereon by the contractor are submitted for approval of the contracting officer prior to the occupation of such areas.

b. The contractor, without expense to the Government, at any time during the progress of the work and when space is needed for other purposes, shall vacate promptly and clean up any part of the grounds allotted to or in use by him, when directed to do so by the contracting officer.

1-19. Removal of rubbish. - The contractor shall keep the site free from rubbish. Suitable spoil areas for receiving refuse from the grounds shall be provided, and the rubbish shall be removed and disposed of as directed by the contracting officer. At the conclusion of the work, the site shall be cleaned up and all rubbish and unused materials shall be removed.

1-20. Obstruction and danger lights. - In the contractor's use of streets and highways, for the work to be done under these specifications, he shall conduct his operations as approved by the contracting officer and in accordance with State and local laws and regulations. The contractor shall provide, erect and maintain effective barricades, danger signals, and signs on all intercepted roads or highways, and on the site where directed by the contracting officer for the protection of the work and safety of the public. All barricades, obstructions and plant which encroach on or are adjacent to public rights of way shall be provided with lights at night and all such lights shall be kept burning between sunset and sunrise. Such barricades and lights shall conform to the local and State laws. The contractor shall be responsible for all damages resulting from any neglect or failure of these requirements. The expense of these and other safety precautions shall be borne by the contractor.

1-21. Inspection and supervision. - a. General. - The work will be conducted under the general direction of the contracting officer, and will be inspected by inspectors appointed by him who will enforce a strict compliance with the terms of the contract. The contracting officer will furnish on request of the contractor, all location and limit marks reasonably necessary as provided in Paragraph 1-23. The inspectors will keep a record of work done, and see that the location and limit marks are kept in proper order. Work done without proper inspection may not be paid for. The presence of an inspector shall not relieve the contractor of his responsibility for the superintendence required in the proper execution of the work (see Article 8 of the contract). Tests to determine the quality and fitness of material used and work done under these specifications will be made as indicated under that part of the specifications pertinent to the particular kind of work, and as stated in Paragraph 1-37.

b. Facilities to be furnished. - (1) The contractor shall furnish promptly, in accordance with Article 6 of the contract, all facilities, labor, and materials necessary for the safe and convenient inspection and tests that may be required by the contracting officer.

(2) The contractor shall furnish a room, approximately 12 by 20 feet in size, at his concrete mixing plant for a Government

laboratory, to be used for making field tests including the moisture content of aggregates and such other field tests as are prescribed in these specifications under Section VIII and for temporary storage of concrete specimens. The room shall be protected from the weather, properly lighted, and heated, all of which together with the location and capacity shall be subject to the approval of the contracting officer. The contractor shall provide electricity in accordance with Paragraph 1-34.

(3) The contractor shall furnish appropriate quarters for a Government field office. Such quarters shall be a room approximately 12 by 20 feet in size, and otherwise shall conform to the provisions of subparagraph (2) above.

(4) No separate payment will be made to the contractor for providing these facilities. Should the contractor refuse, neglect, or delay compliance with the requirements concerning facilities for inspection and for furnishing the Government field office, the specific facilities may be furnished and maintained by the Government, and the cost therefor will be deducted from any amounts due or to become due the contractor.

c. It is hereby understood and agreed that any instructions or decisions by a superior officer through the contracting officer are to be considered instructions or decisions of the contracting officer in all cases under the terms of the contract where decision rests with the contracting officer.

1-22. Datum and bench marks. - The plane of reference used in these specifications and on the drawings hereof is mean sea level datum. Elevations in feet as specified, and as shown on the drawings are to be determined from a bench mark located near the site of the work, the location, description, and elevation (in feet) of which is as follows:

T.B.M.#4 (U.S.C. & G.S.)

At Chicopee, Hampden County, about 100 yards south of the railroad station, at the southeast corner of the base of Semaphore #32. The top of an iron bolt.

Elevation 81.332 M.S.L.

1-23. Lines and grades. - a. The contractor shall keep the contracting officer informed a reasonable length of time in advance of the time and places at which he intends to do work in order that lines and grades may be given, necessary measurements for record and payment made and progress photographs taken with a minimum of inconvenience to the contracting officer or of delay to the contractor, and the contractor shall have no claim for damages or extension of time on account of delays in giving of lines and grades or due to destruction of such marks and the

consequent necessity for replacement.

b. All lines and grades will be given by the Government inspectors as authorized representatives of the contracting officer, but the contractor shall provide at his own expense such temporary structures and such materials and give such assistance as may be required by the contracting officer and the marks given shall be carefully preserved. After lines, elevations and grades for any part of the work have been given by the contracting officer, the contractor will be held responsible for the proper execution of the work to such lines, elevations, and grades, and all stakes or other marks given, shall be preserved by the contractor until their removal is authorized by the contracting officer. The contracting officer may require the work to be suspended when for any reason such marks cannot be properly followed.

1-24. Interpretation of specifications. - The contracting officer shall decide all questions which may arise as to the performance, quantity, quality, acceptability, fitness, and rate of progress of the several kinds of work to be done or materials to be furnished under this contract. He shall decide all questions which may arise as to the interpretation of the specifications and of drawings used and as to the fulfillment of this contract on the part of the contractor, and as to defects in the contractor's work. His determination and decision shall be final, subject to appeal as provided for in Article 15 of the contract.

1-25. Water supply. - The contractor shall provide, at convenient points, ample supplies of water of proper quality for all the operations required under this contract.

1-26. Use of explosives. - The contractor shall use the utmost care in the use of explosives necessary for the prosecution of the work, not to endanger life or property. All blasting operations shall be conducted by experienced men only. The handling and use of explosives shall be done strictly in accordance with the latest methods and rulings to insure safety, in accordance with the specifications issued by the U. S. Bureau of Mines; and in compliance with the local and State laws. Failure to observe necessary precautions will be sufficient grounds for temporary suspension of the work. All explosives shall be transported and stored in a secure manner, and in accordance with local and State laws; all vehicles and such storage places shall be marked clearly "DANGER - EXPLOSIVES", and shall be in the care of competent watchmen at all times. In no case shall caps or other detonators be stored or transported with dynamite or other explosives. The location of magazines for the storage of explosives and for the separate storage of detonators shall be subject to the approval of the contracting officer.

1-27. Standard stock products. - All material, supplies and articles furnished shall, wherever so specified and otherwise wherever

practicable, be the standard stock products of recognized reputable manufacturers. The standard stock products of manufacturers other than those specified will be accepted if, in the opinion of the contracting officer, they are equal in strength, durability, usefulness and convenience for the purpose intended. (See Article 7 of the contract). Any changes required in the details and dimensions shown on the drawings for the substitution of standard stock products, other than those provided for, shall be properly made as approved by the contracting officer, and at the expense of the contractor.

1-28. Safety requirements. - a. The contractor shall make all necessary provisions to protect the public safety, and to maintain and protect existing structures of whatever kind, and shall repair all damages done to such structures. He shall give ample notification to the proper officials of any city or town and of any public utility or other corporation before entering upon their respective public ways or rights of way to perform the required work of construction. Such construction shall conform to the customary regulations and requirements of said officials or corporations. The contractor shall give all notices, take out all permits, and pay all such charges, fees, water and other rates that may be necessary in the carrying out of the work.

b. The contractor shall be responsible that his employees observe the laws of the United States affecting all operations at the site under the contract. He shall comply with all applicable Federal and state laws under which he is operating, including those concerning the inspection of boilers and other equipment, the licensing of engineers, welders and other employees.

c. The contractor shall conduct the work with due regard to adequate safety and sanitary requirements and shall maintain his plant and equipment in safe condition. He shall conform to current safety engineering practices as set forth in the Manual of Accident Prevention in Construction, published by the Associated General Contractors of America; the publications of the National Safety Council, and with all applicable state or local safety and sanitary laws, regulations and ordinances.

d. The contracting officer will require such safety and sanitary measures to be taken as the nature of the work, and the conditions under which it is to be performed, demand. Such measures shall include:

(1) The provision of adequate extinguishers or fire-fighting apparatus in and about all buildings and plant erected or used at the site of the work;

(2) Adequate first aid and life-saving equipment;

(3) Adequate illumination during night operations;

(4) Instruction in accident prevention to reach all employees;

(5) Such machinery guards, safe walkways, scaffolds, ladders, bridges, gang-planks, and other safety devices, equipment, and apparel as are necessary to prevent accidents or injuries.

(6) The provision of watchmen and flagmen at railroad crossings and street intersections where traffic may be affected by the contractor's trucking operations.

e. The contractor shall report promptly to the contracting officer in form prescribed by him, all accidents occurring at the site of the work.

f. The contracting officer will notify the contractor in writing of any non-compliance with the foregoing provisions and the corrective action to be taken. If the contractor fails or refuses to comply promptly, the contracting officer may issue a stop order suspending all or any part of the work. Such stop order will be sent by registered mail to the contractor at the site of the work and shall be accepted by him as sufficient notice thereof. Work shall thereupon be suspended as directed. When satisfactory corrective action is taken, a resumption order will be issued. No part of the time lost due to any such stop order shall be made the subject of a claim for extension of time or for excess costs or damages by the contractor.

1-29. Access to work. - The contracting officer, his authorized representative and other duly authorized agents and employees of the Government may at all times enter upon the work and premises used by the contractor, or into his works, or shops. The contractor shall provide safe and proper facilities for such entrance and for the inspection of materials and workmanship.

1-30. Interference with other contractors. - The contractor shall be subject to Article 13 of the contract regarding interference with materials, appliances or employees of the Government or of any other contractor who may have work at the site. As far as practicable, all contractors shall have equal rights to the use of all roads and grounds. In case of disagreement regarding such use, the decision of the contracting officer shall govern, subject to appeal under Article 15 of the contract.

1-31. Purchase of supplies and materials. - a. Preference for domestic articles. - (1) Because the materials listed below or the materials from which they are manufactured are not mined, produced, or manufactured, as the case may be, in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality, their use in the work herein specified (subject to the requirements of the specifications) is authorized without regard to the country of origin;

Platinum	Nickel	Asbestos
Chromium	Rubber	China wood oil (tung oil)
Cork	Teakwood	Balsa wood
Jute	Sisal	English ball clay
Kauri gum	Silk	English china clay
Lac	Tin	Natural copper nickel alloy

(2) Articles, materials, or supplies, manufactured in the United States and containing mercury, antimony, tungsten, or mica of foreign origin may be used (subject to the requirements of the specifications) in the work herein specified, because such manufactured articles, materials, or supplies have been manufactured in the United States substantially all from articles, materials or supplies mined, produced, or manufactured, as the case may be, in the United States.

b. Purchasing procedure. - Two copies of all purchase orders showing firm names and addresses, and of all shipping bills or memoranda of shipments received showing car initials and numbers, when shipped by railroad, shall be furnished promptly to the contracting officer. Such orders, shipping bills or memoranda shall clearly indicate weights, and shall be so worded or marked that each item, piece or member can be definitely identified on the drawings.

1-32. Minor modifications. - The right is reserved to make such minor changes in the execution of the work to be done under these specifications as, in the judgment of the contracting officer, may be necessary or expedient to carry out the intent of the contract; provided that the unit cost to the contractor of doing the work shall not be increased thereby, and no increase in unit price over the contract rate will be paid to the contractor on account of such changes.

1-33. Protests and appeals. - If the contractor considers any work demanded of him to be outside the requirements of the contract or if he considers any action or ruling of the contracting officer or of the inspectors to be unfair, the contractor shall without undue delay, upon such demand, action, or ruling, submit his protest thereto in writing to the contracting officer, stating clearly and in detail the basis of his objections. The contracting officer shall thereupon promptly investigate the complaint and furnish the contractor his decision, in writing, thereon. If the contractor is not satisfied with the decision of the contracting officer, he may, within thirty days, appeal in writing to the Chief of Engineers, whose decision shall be final and binding upon the parties to the contract. Except for such protests or objections as are made of record in the manner herein specified and within the time limit stated, the records, rulings, instructions or decisions of the contracting officer shall be final and conclusive. The Chief of Engineers has been designated by the Secretary of War as his duly authorized representative to make final decision and to take other action where the terms of the contract require that such decision or action shall be by the Head of Department concerned or his duly author-

ized representative." All appeals from decisions of the contracting officer authorized under the contract shall, therefore, be addressed to the Chief of Engineers, U. S. Army, Washington, D. C. The appeal shall contain all the facts or circumstances upon which the contractor bases his claim for relief and should be presented to the contracting officer for transmittal within the time provided therefor in the contract.

1-34. Electric power to be furnished by the contractor. - The contractor shall make arrangements for, shall pay for, and furnish all necessary power to carry on the work, including sufficient power for lighting and other miscellaneous uses in buildings furnished by the contractor for Government use during the life of the contract. No separate payment will be made to the contractor for the power furnished.

1-35. Rate of wages. - a. In accordance with Article 17 of the contract, the minimum wages shown in the following schedule, as approved by the United States Department of Labor, shall be the minimum rates of wages to be paid by the contractor for work under this contract. Corresponding rates for occupations not listed below will be furnished upon application by the contractor.

Designation	Wage Rate - Hourly
Air Tool Operator (Jack Hammer)	$ .60
Blacksmith	1.20
Blaster (headman)	1.00
Brickmason	1.625
Brickmason's Tender (hod carrier)	1.00
Carpenter	1.25
Electrician	1.375
Fireman	.75
Laborer (common)	.57
Mechanic (repairman)	1.00
Oiler	.75
Powderman Monkey	.60
Ironworker, Structural	1.375
Reinforcing Rod Placer	1.375
Operators of Power Equipment:	
Crane and derrick	1.50
Dragline	1.50
Shovel	1.50
Operator of Small Equipment:	
Compressor (under 400 cu. ft.)	.75
Compressor (400 cu. ft. or over)	.875
Concrete Mixer (under 5-bag)	.75
Concrete Mixer (5-bag or over)	1.25

Designation	Wage Rate - Hourly
Operator of Small Equipment: (continued)	
Pump	$ .75
Tractor (40 horsepower or less)	.75
Tractor (over 40 horsepower)	1.00
Truck (1-1/2 tons and under)	.57
Truck (over 1-1/2 tons)	.65

b. Any class of laborers and mechanics not listed above, which will be employed on the work, will be classified or reclassified by the contracting officer to conform to the foregoing schedule. In the event of disagreement between the contracting officer and the contractor as to such classification or reclassification, the question, accompanied by the recommendation of the contracting officer, will be referred to the United States Department of Labor for final determination.

c. The above list of wages shall be posted by the contractor in a conspicuous place on the work.

1-36. Reports to Department of Labor. - The contractor shall report and shall cause all subcontractors to report in like manner, within 5 days after the close of each calendar month, on forms to be furnished by the Department of Labor, the number of persons on their respective payrolls, the aggregate amounts of such payrolls, the man-hours worked, and the total expenditures for materials. He shall furnish to the Department of Labor the names and addresses of all subcontractors on the work at the earliest date practicable, provided that the foregoing shall be applicable only to work at the site of the construction project.

1-37. Standard tests, qualities and guarantees. - a. All materials, supplies and parts and assemblies thereof, entering into the work to be done under these specifications, shall be tested as specified, or otherwise required, in conformity with the best modern approved methods for the particular type and class of work.

b. Unless waived in writing by the contracting officer, all tests and trials shall be made in the presence of a duly authorized representative of the contracting officer. When the presence of the inspector is so waived, sworn statements, in duplicate, of the tests made and the results thereof, shall be furnished to the contracting officer by the contractor.

c. Costs of all tests and trials, excepting (1) the expense of the Government inspector, and (2) cement, concrete aggregate and cylinder tests, and (3) tests on embankment materials, shall be borne by the contractor and shall be included in the contract price. (See Paragraph 8-11).

d. All materials, parts and equipment shall be of the highest grade, free from defects and imperfections, of recent manufacture, new and unused. Workmanship shall be of the highest grade and in accordance with the best modern standard practice.

1-38. Protection of existing structures. - During construction operations, on work covered by these specifications, the contractor shall protect all existing structures and accepted work. Any disturbances or damage to any structures by operations under these specifications shall be repaired promptly by the contractor without cost to the Government.

1-39. Interference with local traffic. - The contractor shall construct and maintain access roads for the use of local residents over or around construction work where required by the contracting officer.

1-40. Final acceptance and payment. - As soon as practicable after the completion of the work, the contracting officer will make a thorough examination of same and if it is found to comply fully with the requirements of the specifications, it will be accepted, and final payment will be made in accordance with Article 16 of the contract.

1-41. Approval. - This contract shall be subject to the written approval of the Division Engineer, North Atlantic Division, and shall not be binding until so approved.

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SECTION II. PREPARATION OF SITE (Item 1).

2-01. Work included. - Clearing, grubbing, and disposal of materials shall be done as directed by the contracting officer, within the limits shown on the drawings, or as staked in the field.

2-02. Clearing. - a. Trees and other obstructions shall be removed by the contractor from the sites of the proposed structures when and as directed by the contracting officer and may be removed from other areas only to the extent directed or permitted. The contractor shall preserve and protect from injury all trees not required to be removed.

b. All timber, undergrowth, brush, logs, woods, and debris of any nature shall be cleared and removed from the site of the work as directed by the contracting officer.

2-03. Grubbing. - a. The areas to be grubbed shall include those portions of the areas previously cleared as may be directed by the contracting officer.

b. All such areas shall be thoroughly grubbed of all stumps, roots, buried logs, and other objectionable matter. Tap roots and other projections over 1-1/2 inches in diameter within the limits of the pumping station, conduit and other structures shall be grubbed out to a depth at least 3 feet below the ground surface, unless otherwise directed by the contracting officer.

2-04. Removal of structures. - The removal of existing structures and utilities required to permit the orderly prosecution of the work covered by these specifications shall be accomplished by local agencies unless otherwise shown on the drawings. Whenever a telephone or telegraph pole, pipe line, conduit, fence, sewer or other utility is encountered and must be removed to permit completion of the work, the contracting officer will notify the proper local authorities, and the designated utility will be removed promptly.

2-05. Disposal of materials. - All materials removed, as specified above, shall be disposed of by burning or by removal to approved disposal areas as directed. No material shall be thrown into, or left along the bank of, the river. The disposal of material shall closely follow the operations of clearing and grubbing so that brush and other debris will not be washed into the river in case of high water. At no time shall material be placed on land adjacent to the construction area. No damage of any nature shall be inflicted upon adjoining property owners by unwarranted entry or disposal of material on adjacent property.

2-06. Measurement and payment. - The quantity to be paid for under Item 1 will be the number of acres cleared. Payment for all work in connection with the preparation of the site as above specified, including the loading, hauling, and disposal of the materials, will be made at the contract unit price for Item 1, "Preparation of Site," for the area actually cleared.

SECTION III. CONTROL OF WATER AND SEWAGE (Item 2).

3-01. Work included. - a. All permanent construction shall be carried on in areas free from water unless otherwise authorized by the contracting officer. Necessary shoring, sheeting and pumping, and clearances for the permanent work shall be provided for (see Paragraph 4-01 d (4) and 4-03 d).

b. If the water surface exceeds elevation 52.0 and causes damage to the permanent work, during the period of the contract, such damage shall be repaired by the contractor and will be paid for by the Government at the contract unit prices, where such prices are applicable, and otherwise on the following basis: The contractor shall, when directed in writing by the contracting officer, furnish the necessary materials, labor and plant and perform such additional work at the cost to the contractor of necessary labor and materials employed by or incorporated into the work together with the cost of insurance of employees and the public where such insurance is carried and such allowance for the use of any plant or machinery actively employed on this extra work as may be determined by the contracting officer plus a commission of 15 percent to cover the use of tools, general superintendence, office accounting, engineering expenses and profit (see Paragraph 1-16).

c. The contractor shall maintain existing operating sewers during construction so that their discharges are unimpeded, and shall divert the water and sewage away from the permanent construction by flumes or otherwise as directed by the contracting officer. Necessary temporary additions to the existing sewer system shall be provided.

3-02. Cofferdam protection. - Any type of cofferdam may be used subject to the approval of the contracting officer. The cofferdams shall be located so as to provide adequate clearance around the permanent work, and shall be built to such height and section as may be adequate to protect the permanent work. The contractor shall be responsible for the adequacy of the cofferdam protection to elevation 52.0 (see Paragraph 3-01 b), and for all damage to the permanent or temporary work resulting from failure or washing out of cofferdams. Subject to the approval of the contracting officer, materials excavated from the work or other areas may be used for constructing cofferdams.

3-03. Maintaining existing sewers. - Provisions shall be made to maintain the satisfactory operation of existing sewers throughout the construction period, unless otherwise authorized by the contracting officer. The contractor shall install temporary sewer extensions and connections, including valves and specials, necessary to divert the sewage and drainage away from the work. The installation of temporary sewer extensions and connections shall include all shoring, excavation, backfilling and other incidental work required in connection therewith.

3-04. Pumping and draining. - Before beginning work within the cofferdams, the sewage shall be diverted and the construction areas shall be unwatered. The areas shall be kept free from water and sewage throughout the working period, unless otherwise authorized by the contracting officer.

3-05. Removal of cofferdams and temporary sewer connections. - When the work is finished within the cofferdams or when the need for the cofferdams and temporary sewer connections no longer exists, the temporary protection works and sewer connections shall be removed to spoil areas or otherwise as approved by the contracting officer.

3-06. Payment. - The contract price for Item 2 shall include payment for control and diversion of water and sewage during construction, the construction, maintenance, rebuilding in case of destruction, unwatering and removal of cofferdams, construction and removal of temporary sewer connections, and maintenance of unobstructed flow through the existing sewers encountered in the work. Payment will be made in one sum at the contract price for Item 2, "Control of Water and Sewage", when, in the opinion of the contracting officer, the permanent construction no longer requires the protective measures specified under Item 2, and when such protective measures have been removed to the satisfaction of the contracting officer.

SECTION IV. EXCAVATION (Items 3 to 5 incl.)

4-01. General provisions. - a. Scope of work. - The location and character of the proposed structures and the location and logs of borings and test pits are shown on the drawings (see Paragraph 1-04). It is the intent of the Government that excavation be made to the lines and grades given thereon but the right is reserved to modify any part of the work if, in the opinion of the contracting officer, conditions require such modification (see Articles 3 and 4 of the contract.)

b. Disposal of material. - Material from the excavations shall be used, if possible, in the permanent construction as directed by the contracting officer. No material shall be wasted unless specifically authorized by the contracting officer. If, at the time of excavation, it is not possible to place the material in the proper section of the permanent construction, it shall be stock-piled in approved areas for later use. Materials from the excavation that are unacceptable for use in the permanent construction shall be wasted in spoil areas in approved locations as directed by the contracting officer. Upon completion of the work, spoil areas shall be graded and dressed neatly to the satisfaction of the contracting officer.

c. Measurement. - (1) Excavation for structures will be measured in place and the volume thereof will be computed between the original ground surface as determined by a survey made just prior to the commencement of the work and the pay lines shown on the drawings.

(2) Where pay lines are not shown on the drawings, measurement will be made of the volume between the original surface as determined from the survey made just prior to the commencement of the work and the lines and grades established by the contracting officer.

d. Payment. - (1) Items included. - The contract prices for the various classes of excavation shall include the cost of all labor, plant and incidental costs, for excavating, loading, hauling and disposal of the material in the embankment or spoil areas, including any stock-piling and rehandling, and the grading and dressing of spoil areas.

(2) Construction roads. - The cost of construction and maintenance of roads and bridges for the contractor's use will not be paid for as such but the cost thereof shall be included in the contract prices for the other items of work.

(3) Pay lines. - Payment for all structure excavations will be made to the pay or slope lines shown on the drawings regardless of whether or not it is necessary to remove the material to slopes greater or less than those shown. No payment will be made for excavation outside of the limits described above, and the contractor will be required to backfill any such excess excavation with approved material, or with additional concrete where excess excavations are adjacent to concrete structures, at his own expense.

(4) Shoring. - Where approved by the contracting officer, shoring may be used in lieu of excavation to the slope or pay lines shown on the drawings. The contractor shall be responsible for the unfinished work, and that workmen shall be safe from danger of caving or slides while making structure excavations. Shoring shall be erected in a safe and workmanlike manner, and shall be placed in such a way as to afford ready inspection of and ample clearance for the permanent work. Shoring shall be removed upon completion of the permanent work or as soon as the construction does not require its use, or may be left in place if approved by the contracting officer. No payment will be made for temporary shoring but the cost thereof shall be included in the contract price for the excavation. Measurement for payment for excavation will be made to the pay lines specified in Paragraph 4-01 d(3).

(5) Temporary drains. - The contractor shall maintain the site of the work and adjacent grounds in a well drained condition. Temporary drains and ditches required shall be constructed by the contractor at his own expense.

4-02. Classification. - All materials excavated will be classified as follows:

a. Common excavation shall include the removal of all materials except excavation from stock-piles, to the lines and grades shown on the drawings or established by the contracting officer.

b. Detailed classification is as follows:

(1) Common Excavation - General (Item 3) (see Paragraph 4-03).

(2) Removal of Concrete Headwall (Item 4) (see Paragraph 4-04).

(3) Removal and Replacement of Existing Sewers and Drains (Item 5) (see Paragraph 4-05).

4-03. Common excavation - general (Item 3). - a. Work included. - The contractor shall excavate and dispose of the materials classified as common excavation-general above and below the mean water level in the river to the lines and grades shown on the drawings for the respective areas, or as otherwise directed by the contracting officer. Excavation shall be performed in accordance with a schedule of operations to be approved by the contracting officer. Common excavation-general includes excavation for the foundation of the pumping station structure, conduit and any other required common excavation for structures, drains and ditches not included in other items of the work.

b. Description. - Excavations shall be made wide enough to permit proper sheeting, bracing and form work where necessary. Foundations for the concrete structures shall be excavated as directed by the

contracting officer to suitable undisturbed foundation material approved by the contracting officer. The impervious, random and pervious materials from the excavation of the existing embankment shall be kept segregated and shall be placed in separate stock-piles for use in reconstructing the embankment (see Paragraphs 5-06 e, f, and g).

c. Shoring. - (See Paragraph 4-01 d(4).

d. Sheeting and pumping. - The contractor shall provide all necessary pumps to unwater the site properly and to keep the site free from water during such time as the work is under construction. The contractor shall provide all labor and materials required to keep the site unwatered during the course of construction, and shall provide all necessary bulkheads, drains, etc., to prevent running water from coming in contact with newly placed concrete or concrete being placed in excavated areas (see Section III).

e. Disposal of materials. - The provisions of Paragraph 4-01 b shall apply. Excavated material not used in permanent construction may be used in temporary construction if approved by the contracting officer.

f. Measurement and payment. - Measurement for excavation work will be by the cubic yard for the amount of material included within the lines and grades shown on the drawings or as established by the contracting officer. Measurement will be made for the volume in place before excavation (see Paragraph 4-01). Payment for all work in connection with excavation including the loading, hauling, and disposal of the materials, will be made at the contract unit price for Item 3, "Common Excavation - General." (see Paragraph 1-05).

4-04. Removal of concrete headwall (Item 4). - a. Work included. - The contractor shall excavate and dispose of the materials in the existing concrete headwall and apron at the river end of the 72-inch segmental block sewer as shown on the drawings.

b. Blasting. - (1) Blasting and the use of explosives shall be conducted as provided for in Paragraph 1-26.

(2) Blasting will be permitted only when proper precautions are taken for the protection of all persons, the work and adjacent property. All damage done to the work or adjacent property shall be repaired at the contractor's expense.

(3) Explosives of such quality and power shall be used in the locations which will, in the opinion of the contracting officer, neither crack nor damage the work outside the lines of excavation.

(4) Approval by the contracting officer of the method of blasting or the strength and amount of the explosive used, will not relieve the contractor of his responsibility in the blasting operations.

c. Disposal of materials. - Excavated materials shall be disposed of as directed by the contracting officer.

d. Payment. - The contract price for Item 4 shall include payment for all work in connection with the satisfactory removal of the concrete structure and disposal of materials, in accordance with the drawings and specifications or as directed by the contracting officer. Payment will be made at the contract price for Item 4, "Removal of Concrete Headwall."

4-05. Removal and replacement of existing sewers and drains (Item 5). - a. Work included. - (1) The contractor shall excavate and dispose of the existing 72-inch segmental block sewer at the locations shown on the drawings or as directed by the contracting officer.

(2) The existing 15-inch V.C. pipe, 12-inch V.C. perforated pipe, double toe, gravel bedding and rock drain shall be removed and later replaced in the same location as shown on the drawings or as directed by the contracting officer. Any broken pipe or wasted rock or gravel shall be replaced without additional payment to the contractor. The V.C. pipe shall be relaid with open joints in accordance with the applicable provisions of Paragraph 7-02.

(3) Existing 72-inch sewers not entirely removed shall be plugged at the open ends with brick masonry as shown on the drawings or as directed by the contracting officer.

b. Payment. - Payment for all work in connection with Item 5 will be made at the contract price for Item 5, "Removal and Replacement of Existing Sewers and Drains". Payment shall include all costs of excavation, removal, disposal, storing and replacing of pipe and materials to be reused, and installing brick masonry plugs. Payment for backfilling will be made at the applicable unit prices. (See Paragraph 1-05.)

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SECTION V. EARTH DIKE (Items 6 and 7).

5-01. Definitions. - The term "embankment" as used in these specifications includes earth fill of all types for replacement of that portion of the earth dike excavated to permit the construction of the conduit (see Paragraph 9-02), and all other specified or directed earth fills within the limits shown on the drawings. The various types of earth fill are "selected impervious" under Item 6, for the blanket on the river side of the embankment; and the "pervious and random" under Item 7 forming the remainder of the embankment.

5-02. Work included. - The contractor shall grade and consolidate materials required for the embankment, to the elevation, lines, grades and cross sections shown on the drawings.

5-03. Materials. - Materials for the embankment shall be obtained from the stockpiles of excavated material. (See Paragraph 4-03 a). Should any additional material be required, it shall be obtained from the required excavations. Brush, roots, sod, any type of organic materials and other perishable or unsuitable material as determined by the contracting officer shall not be placed in the embankment.

5-04. Scarifying. - Immediately prior to the placing of materials in the embankment, the entire foundation of the embankment shall be thoroughly scarified (see Paragraph 5-06 d (2)).

5-05. Filling of excavations in embankment area. - a. General. - The trenches and other excavated areas within the limits of the embankment and as otherwise shown on the drawings shall be filled with random or impervious materials in the dry as directed by the contracting officer. The fill shall be placed in layers, moistened, and rolled in accordance with Paragraph 5-06 whenever, in the opinion of the contracting officer, it is possible to do so. Material which cannot be compacted by roller equipment on account of clearances, shall be spread in 4-inch layers and compacted with hand or power tampers which shall give the degree of compaction required for the embankment. As the fill is brought up, the side slopes of the cut or hole shall be scarified by equipment or by hand if necessary to provide a bond between the fill and the original ground material (see Paragraph 5-06 d (2)).

b. Drain trenches. - The fill for the drain trenches shall be placed in the dry and rolled in accordance with Paragraph 5-06 d. The water shall be drained to a sump and removed by pumps. The fill shall be made by working the materials toward the sump and sloping the surface of the fill longitudinally toward the sump. Well points may be used for drying up the foundation when approved by the contracting officer.

5-06. Rolled fill. - a. General. - The impervious, random, and pervious sections of the embankment shall be constructed with a crown running

with the center line of the dike and with slopes approximately on a 2 percent grade toward the edges of the embankment. This slope shall be maintained until the completion of the embankment, thus bringing up together the impervious, random and pervious sections unless otherwise directed by the contracting officer.

b. Placing. - (1) The contractor may use power shovels, drag lines, or any type of excavating machinery which is capable of excavating the embankment materials in dry condition. The contractor may use any approved method of transporting materials in natural dry condition to approved locations in the embankment. The dumping of the successive loads shall be at locations as directed or approved by the contracting officer. When two or more different materials are being moved into a section of the embankment they shall be spotted and dumped systematically so that in any area of the section there are approximately the required proportions of the material. After dumping, the materials for the impervious section shall be bulldozed or otherwise spread in approximately 8-inch layers and rolled (see Paragraph 5-06 d). The random and pervious materials shall be spread in approximately 12-inch layers and rolled (see Paragraph 5-06 d). Should the material for the various sections of the embankment be too high in water content when dumped, it shall be bulldozed or otherwise spread and harrowed or stirred and left for a sufficient time to allow the surplus water to dry out before being rolled. If, in the opinion of the contracting officer, the rolled surface of any layer of the materials is too smooth to bond properly with the succeeding layer or, if the materials have dried out sufficiently to cause cracks in the surface, it shall be roughened or loosened by a disc harrow, or other approved means, and dampened, if required, before the succeeding layer is placed thereon. All roots, trash, and debris shall be removed promptly from the embankment and disposed of to the satisfaction of the contracting officer. Stones greater than 6 inches in diameter shall be removed from the impervious and random sections and disposed of as directed by the contracting officer. The entire surface of the embankment shall be maintained in such condition that construction equipment can travel thereon. Routing of construction equipment on the embankment shall be subject to direction by the contracting officer.

(2) Any embankment material lost or loosened, after being placed in the embankment and before the completion and acceptance of the work, because of any operation of the contractor or any causes that in the opinion of the contracting officer, were avoidable or under the control of the contractor, shall be replaced to the satisfaction of the contracting officer and without cost to the Government.

(3) Where backfill is to be placed against only one side of a concrete wall or other structure, no backfill material shall be placed until the concrete has been in place at least 10 days and then only by hand or by trucks or bulldozers operating not closer to the wall than the height of the wall above the foundation. No backfill shall be compacted, nor placed by dragline, clamshell, or other equipment which drops the material in relatively large quantities, nor spread by equipment operating closer to the wall than the height of the wall, until the concrete has been in place at least 14 days.

(4) The contractor shall cease work on the embankment at any time when satisfactory work cannot be done on account of rain, high water, cold weather, or other unsatisfactory conditions.

c. Moisture control. - To obtain the desired compaction for the varying kinds of materials used, the moisture content of the material being placed shall be the optimum required for satisfactory compaction as determined by the contracting officer. If required, the compacted surface shall be sprinkled as directed immediately before placing each new layer. The moisture content shall be sufficient to dampen the filled materials as required, but the amount of sprinkling shall be controlled so that no free water will appear on the surface during or subsequent to the rolling. An adequate supply of water shall be available. Jets shall not be directed at the embankment material with such force that the finer materials are washed out.

d. Compaction. - (1) Tamper type roller. - Rolling for the impervious section of the embankment shall be done by a tamper type twin roller such as a "sheeps-foot" roller, water or sand ballasted, having tamping feet uniformly staggered over its cylindrical surface, and equipped with cleaners; or other satisfactory type of tamper roller as approved by the contracting officer. Each tamping foot shall project approximately 7 inches from the roller's cylindrical surface and shall have a face area of not less than 5 and not more than 7 square inches. The spacing shall be such as to provide a minimum of two tamping feet for each square foot of cylindrical surface. Addition or reduction in the number of tamping feet shall be made when directed by the contracting officer. The total weight of the roller in pounds divided by the total area of the maximum number of tamping feet in one row parallel to the axis of the roller shall be not less than 115 pounds per square inch tamping foot area with the drum empty, and not less than 200 pounds per square inch tamping foot area with the drum ballasted. The design and operation of the tamping roller shall be subject to the approval of the contracting officer. Operation of rolling or hauling equipment will not be allowed nearer than 3 feet from surfaces of concrete structures.

(2) Rolling impervious section. - When the moisture content and condition of the spread impervious layers of the embankment are satisfactory to the contracting officer, the contractor shall roll the impervious section of the embankment with tamper type twin rollers. Each set of twin rollers shall be pulled by a crawler type tractor of suitable power, weighing not less than 20,000 pounds, manufacturer's standard weight, at a speed of approximately 2-1/2 miles per hour. Each square foot of each layer of the embankment material shall be compacted by not less than six passes of the rollers. Additional passes of the rollers shall be made if necessary to obtain the compaction desired by the contracting officer. Successive trips of the rollers shall overlap by at least 2 feet. Failure to comply with this requirement for careful rolling will be a cause for additional trips. Where new material abuts old material, either in place or in embankment, the old material shall be cut or broken by machine or hand methods approved by the contracting officer, until it shows the char-

acteristic colors of undried materials, and the rollers shall work on both materials, bonding them together. Portions of the earth fill which the roller cannot reach for any reason shall be thoroughly compacted in 4-inch layers by tamping with hand or power tampers. The degree of compaction for such portions of the earth fill shall be equivalent to that obtained by sprinkling and rolling as specified for the other portions of the earth fill.

(3) Rolling random and pervious sections. - Rolling of the random and pervious sections of the embankment shall be the same as specified above except that a minimum of 3 passes of the rollers will be required. If, in the opinion of the contracting officer, better compaction can be obtained by the use of a plain cylindrical roller, or a Parson's disc tamping roller, the use of such a roller may be required. The disc tamping roller shall weigh not less than 1,100 pounds per linear foot. When conditions of the work so require, as determined by the contracting officer, rolling may be done by a crawler type tractor weighing not less than 20,000 pounds; in such cases a minimum of four passes of the tractor treads on each square foot of embankment area will be required.

(4) Tests for compaction. - Samples of all embankment materials for testing, both before and after placing and compaction, will be taken at frequent intervals by the contracting officer. Corrections, adjustments and modifications of methods, selection of materials and moisture content will be made from these tests to secure the maximum density of the materials in the embankment (see Paragraph 5-03 c).

e. Impervious fill. - Impervious fill shall be selected and secured from stockpiles or required excavations as directed by the contracting officer and shall be placed in the impervious section of the embankment throughout the entire length (see Paragraph 4-03 b).

f. Random fill. - Random fill shall be secured from stockpiles or required excavations as directed by the contracting officer, and shall be placed in the random sections of the embankment. In general this material shall be placed so the coarser portions are toward the pervious section and the finer portions near the impervious section, so that a gradational transition is effected from the impervious to the pervious section (see Paragraph 4-03 b).

g. Pervious fill. - The pervious fill shall be selected and secured from stockpiles or required excavations as directed by the contracting officer, and shall be placed in the pervious section of the embankment. The pervious section of the embankment shall be graded from the finer materials near the random section to the coarser materials near the land side face of the embankment. Special care shall be taken to place the coarser material and cobbles adjacent to the land side face of the embankment (see Paragraph 4-03 b).

5-07. Removal of objectionable material. - The contractor shall excavate, remove and dispose of any material from the embankment sections which the contracting officer considers objectionable in such locations, and refill the area as directed in accordance with Paragraph 5-05.

5-08. Slides. - In case of slides in any part of the embankment during the construction or after completion, but prior to the final acceptance of the work, the contractor shall cut out and remove the area specified by the contracting officer and then rebuild the excavated area in accordance with these specifications.

5-09. Frozen materials. - No earth shall be placed upon a frozen surface, nor shall frozen earth, snow or ice be placed in the embankment. In cases of emergency the contracting officer may require frozen material to be stock-piled for later use in the embankment.

5-10. Shrinkage or settlement. - No measurement will be made of additional material placed on account of settlement of the foundation or shrinkage during construction. The cost of placing and compacting such additional material shall be included in the contract prices for the various items of fill.

5-11. Temporary drains and ditches. - The contractor shall maintain the site of the work and the grounds immediately adjacent thereto, free from collected surface water if, in the opinion of the contracting officer such collected water affects the safety or condition of the work. Such temporary drains and ditches shall be constructed as are deemed necessary and directed by the contracting officer.

5-12. Topsoil and sodding. - a. Placing topsoil. - Unless otherwise authorized by the contracting officer, a suitable topsoil shall be placed on the slopes of the earth dike as shown on the drawings. Payment for placing topsoil will be made at the contract unit price for Item 36 (see Paragraph 20-01 e. (1)).

b. The areas upon which topsoil has been placed shall be sodded and seeded as specified in Paragraph 20-01. Payment for seeding and sodding will be made at the contract unit price for Item 37. Measurement and payment will be made as specified in Paragraph 20-01 e (2).

5-13. Surfacing for top of dike. - Unless otherwise directed by the contracting officer, the top of the dike shall be surfaced with a layer of gravel as shown on the drawings. Payment for placing the gravel surfacing will be made at the contract unit price for Item 38 (see Paragraph 20-02 e).

5-14. Measurement and payment. - a. The quantities of embankment fill to be paid for will be the number of cubic yards placed as directed, measured in place after compacting (see subparagraph b following). Payment shall include the work of preparing the base, excavation from stockpiles, spreading in layers, wetting, rolling or tamping, trimming to line, and shall include all labor and materials incidental to completing the embankment, not specifically included under other items. Payment will be made at the contract unit prices for Items 6 and 7 as applicable (see Paragraph 1-05).

b. To determine the quantities for which payment will be made, a survey will be conducted prior to the beginning of the placing of the

fill. The true surface condition will be shown by cross sections and profile and the measurement of the quantities will be based upon this survey. The quantities will be the volume between the original surface determined by the foregoing survey and the slope lines and grades as indicated on the drawings, or as established by the contracting officer.

SECTION VI. MISCELLANEOUS FILL AND BACKFILL (Items 8 to 10 incl.)

6-01. Gravel bedding (Item 8). - a. Work included. - The contractor shall place a layer of gravel or crushed stone upon which riprap will be placed at the locations shown on the drawings and as indicated by the contracting officer. The contractor shall also place a layer of gravel or crushed stone of the specified quality required for drains at the locations shown on the drawings or as directed by the contracting officer.

b. Materials. - (1) The screened gravel shall consist of suitable coarse clean gravel satisfactorily graded within the specified limits. Unless otherwise directed, not more than ten percent by weight shall pass a sieve having 10 meshes to the inch, and all shall pass a 2-inch square mesh screen. The material shall be approved by the contracting officer, before delivery is made to the site of the work.

(2) Subject to the approval of the contracting officer, crushed stone may be used in place of gravel. Crushed stone shall consist of angular fragments of uniform quality throughout, free from soft or disintegrated stone, dirt or other objectionable matter. The stone shall be screened and uniformly graded within the specified limits. Unless otherwise directed, not more than ten percent by weight shall pass a No. 4 sieve, and all shall pass a 2-inch square mesh screen. The material shall be approved by the contracting officer before delivery is made to the site of the work.

c. Placing. - The material shall be placed as shown on the drawings or as directed, and with such hand-placing as may be necessary to trim to the required slopes. The contractor will not be required to tamp or roll the material, but shall consolidate it with water to the extent directed so that no settlement will later result.

d. Measurement and payment. - Measurement will be made by the cubic yard for the amount of gravel or crushed stone furnished and placed in the completed work to the lines and grades shown on the drawings or as directed by the contracting officer. Payment for all work in connection with gravel bedding will be made at the contract unit price for Item 8, "Gravel Bedding".

6-02. Semi-compacted backfill (Item 9). - a. Work included. - The contractor shall place, grade and consolidate materials required for semi-compacted backfill around structures outside the limits of the dike section (see Paragraph 6-03 a), and at other locations as directed by the contracting officer.

b. Materials. - Materials shall be borrowed from stockpiles of excavated materials (see Paragraph 4-01 b), or may be obtained directly from required excavations. Backfill material shall be free from stumps, roots, sod, rubbish or other unsuitable materials or substances.

c. Placing. - (1) The material shall be placed in 12-inch horizontal layers with only such hand-placing as may be necessary to trim to the required slopes. The contractor will not be required to roll the material, but will be required to consolidate it with water to the extent directed so that no settlement or voids will later result. Hand tamping shall be done for good compaction at or near pipes and structures and where required by the contracting officer.

(2) Where backfill is to be placed against only one side of a concrete wall or other structure, no backfill material shall be placed until the concrete has been in place at least 10 days and then only by hand or by trucks or bulldozers operating not closer to the wall than the height of the wall above the foundation. No backfill shall be compacted, nor placed by dragline, clamshell, or other equipment which drops the material in relatively large quantities, nor spread by equipment operating closer to the wall than the height of the wall, until the concrete has been in place at least 14 days.

d. Measurement and payment. - Measurement will be made by the cubic yard for the amount of semi-compacted backfill placed in the completed work to the lines and grades shown on the drawings or as directed by the contracting officer. Quantities will be measured in place. Payment for all work in connection with placing semi-compacted backfill will be made at the contract unit price for Item 9, "Semi-compacted Backfill."

6-03. Compacted backfill (Item 10). - a. Work included. - The contractor shall place, grade, and consolidate materials required for the backfill of the concrete and manhole structures and culvert or sewer trenches within the limits of the dike section and under the street, and in consolidated embankments elsewhere as directed by the contracting officer.

b. Materials. - Materials shall be borrowed from stockpiles of excavated materials (see Paragraph 4-01 b), or may be obtained directly from required excavations. Backfill material shall be free from stumps, roots, sod, rubbish or other unsuitable materials or substances.

c. Placing. - The backfills shall consist of materials suitable for the purpose in the opinion of the contracting officer, and shall be placed in successive layers of not more than 12 inches in depth for the full width of the cross section. Each layer shall be compacted thoroughly with a crawler type tractor weighing not less than 20,000 pounds, or as provided in Paragraph 5-06 d (3). A minimum of four passes of the tractor treads on each square foot of backfill area will be required for satisfactory compaction. Portions of the backfill area which the compacting equipment cannot reach for any reason, and the backfill of the reinforced concrete conduit less than 3 feet in depth or elsewhere as directed by the contracting officer, shall be compacted thoroughly in 4-inch layers by tamping with hand or power tampers. The compaction for such portions of the back-

fill shall be equivalent to that obtained by compacting with tractor equipment. See Paragraph 6-02 c (2)..

d. Measurement and payment. - Measurement will be made by the cubic yard for the amount of compacted backfill placed in the completed work to the lines and grades shown on the drawings or as directed by the contracting officer. Quantities will be measured in place after any settlement. Payment for all work in connection with furnishing and placing compacted backfill will be made at the contract unit price for Item 10, "Compacted Backfill".

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SECTION VII. RIPRAP AND DRAINS (Items 11 to 13 incl.)

7-01. Riprap (Item 11). - a. Work included. - The contractor shall furnish all materials, equipment and labor required to construct hand-placed riprap to the lines and grades shown on the drawings, for the earth slopes adjacent to the riverside of the gate structure as shown on the drawings or as required by the contracting officer.

b. Material. - Riprap shall be of durable rock of acceptable sizes, with a specific gravity of not less than 2.65. Riprap shall be approved by the contracting officer before delivery to the site of the work. Rock for riprap shall be angular and of uniform shape so as to furnish an even, reasonably smooth surface. Not more than 5 percent by weight of the rock shall be smaller than one-half cubic foot in volume and at least 75 percent of the rock used shall be from 1 to 2 cubic feet in volume with one dimension approximately equal to the depth of the riprap course.

c. Placing. - The riprap shall be laid to the lines and grades shown on the drawings or as directed. A tolerance of 3 inches above or below the slope line shown on the drawings will be allowed for the finished slope surface of the hand-placed riprap. The rock shall be closely laid on a base of gravel bedding or crushed stone (see Paragraph 6-01), with the dimension approximately equal to the depth of the riprap course normal to the slope, and with joints broken where possible. The joints on the surface of the riprap shall be filled with tightly driven spalls. Large rock shall be well bedded at the edges of the riprap to prevent undermining.

d. Measurement and payment. - The quantity to be paid for under Item 11 will be the number of cubic yards of riprap satisfactorily placed in the completed work to the specified or ordered lines and grades. The contract unit price shall include payment for furnishing, hauling, and placing the riprap. Payment will be made at the contract unit price for Item 11, "Riprap - Hand Placed."

7-02. 36-Inch reinforced concrete pipe (Item 12). - a. Work included. - The contractor shall furnish and install 36-inch reinforced concrete pipe at the location shown on the drawings or as directed by the contracting officer.

b. Material. - Concrete pipe shall conform to Federal Specification SS-P-371 for "Pipe; Concrete, Reinforced."

c. Installation of pipe. - (1) Excavation. - Excavation shall be done as shown on the drawings and as provided for in Paragraph 4-03. Pipe trenches shall have a width 24 inches greater than the outside diameter of the pipe, unless otherwise directed. The bottom of the trench throughout its length shall be carefully formed to fit the circular shape of the pipe, except as otherwise shown on the drawings, so that the pipe shall be firmly supported on the bottom and for at least 3 inches up each side. Where

encountered, rock or boulders shall be removed to a depth of 6 inches below the bottom grade of the trench and the voids backfilled with well compacted suitable material. Suitable excavations shall be made to fit all junctions or other specials wherever needed.

(2) Laying pipe. - All pipe shall be placed in the trench immediately after the excavation is completed. Proper care shall be used in handling the pipe to avoid injury or breakage. The pipe shall be carefully bedded, and properly connected and jointed. Bell holes shall be excavated to insure that each pipe shall rest firmly upon its bed for the entire pipe length. The pipe shall be laid true to the lines and grades shown on the drawings or as staked in the field with bells upgrade and with spigot ends fully entered in the bells. Joints shall be made with cement mortar composed of one part Portland cement and 2-1/2 parts sand. All mortar used shall be thoroughly mixed either by hand or in a mechanical batch mixer. Mortar shall be prepared in such quantities that it can be used entirely before it has attained its initial set. The minimum amount of water sufficient to make a workable mortar shall be used. Cement and sand used in mortar shall conform to the requirements of Paragraphs 8-05 and 8-06. The spigots shall be centered in the bells, and there shall be no shoulders or unevenness of any kind along the bottom half of the pipes. Special care shall be taken that the joint space be of equal width around the pipe, making use of jute or oakum gaskets soaked in cement grout and carefully caulked into the joints. The mortar shall be thoroughly troweled into the joint, and a sufficient overfill shall be made to hold the mortar in the joint firmly in place. The interior of the pipe shall be carefully cleaned after laying to remove dirt, mortar and other obstructions.

(3) Backfilling. - Backfill material shall be evenly spread and compacted over and around the pipe. Backfill over the pipe shall be done in accordance with the provisions of Paragraph 6-03 unless otherwise shown on the drawings or directed by the contracting officer. Hand tamping shall be done as directed.

d. Measurement and payment. - (1) Measurement for payment will be based on the linear feet of pipe installed. Payment for pipe shall include all costs of furnishing and installing pipe, including specials, except the cost of excavation and backfilling. Payment will be made by the linear foot at the contract unit price for Item 12, "36-Inch Reinforced Concrete Pipe".

(2) Payment for excavation will be made at the contract unit price for Item 3 (see Paragraph 4-03 f). Payment for backfilling will be made at the contract unit price for Item 10 (see Paragraph 6-03 d).

7-03. 24-Inch reinforced concrete pipe (Item 13). - a. Work included. - The contractor shall furnish and install 24-inch reinforced concrete pipe at the location shown on the drawings or as directed by the contracting officer.

b. Material. - Concrete pipe shall conform to Federal Specifi-

cation SS-P-371 for "Pipe; Concrete, Reinforced".

c. Installation of pipe. - (1) Excavation. - Excavation may be done in the river bed without the use of cofferdams. Pipe trenches shall have the minimum width necessary to lay the pipe to the required lines and grades as shown on the drawings. The bottom of the trench throughout its length shall be formed to fit the circular shape of the pipe, so that the pipe shall be firmly supported on the bottom and for at least 3 inches up each side. Rock or boulders, where encountered, shall be removed to a depth of 6 inches below the bottom grade of the trench and the voids backfilled with suitable material. Suitable excavations shall be made to fit all junctions or other specials wherever needed.

(2) Laying pipe. - All pipe shall be placed in the trench immediately after the excavation is completed. Proper care shall be used in handling the pipe to avoid injury or breakage. The pipe shall be carefully bedded. The pipe shall be laid with open joints with bells upgrade and with spigot ends entered fully into the bells. Bell holes shall be excavated to insure that each pipe shall rest firmly upon its bed for the entire pipe length. The pipe may be laid on a timber cradle satisfactory to the contracting officer. The pipe shall be laid true to the lines and grades shown on the drawings or as staked in the field. The final section of pipe shall be set in place with the concrete headwall attached. The headwall shall be constructed true to the lines and set to the grades as shown on the drawings. The concrete shall conform to the applicable provisions of Section VIII for concrete, Class "A". Backfilling shall be done sufficiently to hold the pipe in place, as directed.

d. Measurement and payment. - Measurement for payment will be based on the linear feet of the pipe installed. Payment for pipe shall include all costs incidental to the furnishing and installing pipe, including specials, excavation and backfill. Payment will be made by the linear foot at the contract unit price for Item 13, "24-Inch Reinforced Concrete Pipe".

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SECTION VIII. CONCRETE (Items 14 to 17 incl.)

COMPOSITION, CLASSIFICATION AND STRENGTH

8-01. Composition. - Concrete shall be composed of cement, fine aggregate, coarse aggregate and water, so proportioned and mixed as to produce a plastic, workable mixture in accordance with all requirements under this section, and suitable to the specific conditions of placement.

8-02. Classification. - Except where required to meet special conditions all concrete shall be either Class "A" or Class "B", as designated in Section IX and on the drawings for the various parts of the work in accordance with the conditions of application and the proportions of materials and strengths required.

8-03. Strength. - The mixes will be designed to secure concrete having at least the following compressive strengths at the age of 28 days, as determined by breaking standard 6-inch diameter by 12-inch height or 8-inch diameter by 16-inch height test specimens:

Class	Average for any 25 consecutive cylinders	Minimum for any one cylinder
A	3400 lbs. per sq. in.	2600 lbs. per sq. in.
B	3000 lbs. per sq. in.	2200 lbs. per sq. in.

8-04. High-early-strength concrete. - High-early-strength concrete made with high-early-strength Portland cement or other special cements shall be used only when specifically authorized by the contracting officer. The 7-day compressive strength of concrete of any class, when made with high-early-strength cement, shall be at least equal to the specified minimum 28-day compressive strength for that class. All provisions of these specifications, except for cement, shall be applicable to such concrete. Any high-early-strength cement used shall be approved by the contracting officer before use.

MATERIALS

8-05. Portland cement (Item 14). - a. The contractor shall furnish Portland cement of the quality herein specified in sufficient quantity for the work required. Cement for all concrete, grout and mortar, except as specified in subparagraph b, shall conform to Federal Specification SS-C-206, for "Cement, Portland, Moderate-Heat-of-Hardening, September 30, 1936," except that Paragraph E-7, Heat of Hydration, will be considered inoperative.

b. High-early-strength Portland cement. - Cement for high-early-strength concrete shall be in accordance with Federal Specification SS-C-201 for "Cement, Portland, High-Early-Strength."

c. Special test requirements. - Cement will be tested by the Government at the Central Concrete Laboratory, West Point, N. Y. No cement shall be used until notice has been given by the contracting officer that the test results are satisfactory. Cement which has been stored, other than in bins at the mills, for more than 4 months after being tested shall be retested before use. Ordinarily, no cement shall be used until after it has satisfactorily passed both the 7 and 28-day tests, but in cases of emergency the contracting officer may waive the 28-day tests and permit the use of cement which has satisfactorily passed the soundness and 7-day tests; provided it is the product of a quarry and mill having established a reputation of not less than 3 years' standing for the production of high-grade cement. If the tests prove any cement unsatisfactory, which has been delivered at the site of the work, such cement shall be removed promptly from the work and its vicinity.

d. Identification. - Cement shipped in bags shall be identified by the manufacturer by marking or tagging the bags with the identifying number or symbol of the Federal Specification under which it was manufactured. Bulk shipments of cement shall be likewise identified by a suitable device affixed to each car or other type of bulk carrier. Marking or tagging shall be done at the mill.

e. Quality and packages. - All cement shall be dry, finely ground and free from lumps or caking. Unless otherwise permitted, the cement shall be delivered in canvas bags or other strong, well-made packages, each plainly marked with the manufacturer's brand. The weights of such bags shall be uniform. Packages received in broken or damaged condition will be rejected or accepted only as fractional packages. Cement shall be stored in a satisfactory manner so as to be unaffected by moisture, keeping each carload separate until the results of the 28-day tests are known. Suitable accurate scales shall be provided by the contractor for weighing the cement.

f. Records of cement used. - The contractor shall furnish to the contracting officer, at the end of each day's work, a statement showing in such detail as he may reasonably require, the quantity of cement used during the day at each part of the work.

8-06. Fine aggregate. - a. Composition. - Fine aggregate shall be natural sand.

b. Quality. - Fine aggregate shall consist of hard, strong, durable and uncoated particles.

c. Grading. - (1) Except as provided in (2) below, fine aggregate shall conform to the following requirements:

Total passing	Percent by weight
No. 4 sieve	95 - 100
No. 16 sieve	45 - 75

Total passing	Percent by weight
No. 50 sieve	10 - 25
No. 100 sieve	1.5 to 7

(2) Deficiencies in the percentages of fine aggregate passing #50 and #100 sieves, as required in the above gradation, may be remedied by the addition of pozzuolanic or cementitious materials, excepting Portland cement; provided, at least 5 percent passes the #50 sieve and the aggregate is of proper consistent gradation within the specified limits. Such added material, which will be considered and included as fine aggregate, shall conform to the requirements in Paragraph 8-08 and shall be in sufficient quantity to meet the minimum requirements above for percentage passing #100 sieve and otherwise to produce the workability required by the contracting officer. The quantity and characteristics of any material used for the purpose of correcting workability shall be such that when the concrete is gaged to the proper consistency, the total water content shall not exceed by more than one gallon per cubic yard the minimum quantity required for proper consistency when not using the admixture. The blending of any material with the original naturally graded sand to remedy deficiency in gradation shall be accomplished in charging the mixer, unless otherwise specifically authorized by the contracting officer.

d. Deleterious substances. - The substances designated shall not be present in excess of the following amounts:

	Percent by weight
Clay lumps	1
Material removed by decantation from aggregates	3
Shale	0.5

e. Mortar strength. - Mortar specimens made with the fine aggregate shall have a compressive strength at 28 days of at least 90 percent of the strength of similar specimens made with Ottawa sand having a fineness modulus of 2.40+ 0.10 and the same cement.

f. Tests. - Fine aggregate shall be subject to careful, thorough analyses, including magnesium sulphate soundness tests (see Paragraph 8-07 d), to determine conformity with all requirements of these specifications.

8-07. Coarse aggregate. - a. Composition. - Coarse aggregate shall be washed gravel, crushed stone or any approved mixture of washed

gravel and crushed stone.

b. Quality. - (1) Coarse aggregate shall consist of hard, tough and durable particles free from adherent coating. It shall contain no vegetable matter nor soft, friable, thin or elongated particles in quantities considered deleterious by the contracting officer. The substances designated shall not be present in excess of the following amounts (by weight):

Soft fragments	5%
Clay lumps	1/4%
Removed by decantation	1%

When the material removed by decantation consists essentially of crusher dirt, the maximum amount permitted may be raised by 1-1/2 percent. When crushed stone is used, the crusher shall be equipped with a screening system which will entirely separate the dust from the stone and convey it to a separate bin.

(2) Aggregate which has disintegrated or weathered badly under exposure conditions similar to those which will be encountered by the work under consideration, shall not be used.

c. Size. - (1) Coarse aggregate shall be well graded from fine to coarse so that concrete of the required workability, density, and strength can be made without the use of an excess amount of sand, water, or cement.

For Class "A" concrete, required for Item 15, the maximum size mesh screen for the aggregate shall be not less than 3/4 inch nor more than 2 inches.

For Class "B" concrete, required for Item 16, the maximum size mesh screen for the aggregate shall be not less than 1 inch nor more than 2 inches, unless otherwise specified.

(2) When the maximum size mesh screen is greater than 1 inch, the aggregate shall be separated, and the specified sizes delivered separately to individual proportioning hoppers, in accordance with the following:

For Maximum Size Mesh Screen, 1 inch to 2 inches inclusive:

(1) No. 4 to 1/2 maximum size mesh screen, inclusive.

(2) Over 1/2 maximum size to and including full maximum size mesh screen.

Within any of the above-indicated size-limits, not less than 85 percent of the material shall be retained on a standard square mesh screen of the minimum size indicated and not more than 5 percent shall be retained on a standard square mesh screen of the maximum size indicated.

(3) The grading of the coarse aggregate, in the mixed concrete, shall fall within the following limits:

	(Percent by weight) Passing
Maximum size mesh screen (square mesh)	97 - 100
1/2 maximum size mesh screen (square mesh)	40 - 70
No. 4 sieve	0 - 6

d. Tests. - Coarse aggregate will be subjected to freezing and thawing tests and to careful, thorough analyses to determine conformity with all requirements of these specifications. Coarse aggregate will be subjected to 10 cycles of the magnesium sulphate test for soundness. No aggregate shall be used which develops a loss in excess of 10 percent by weight.

8-08. Material added for workability. - a. The use of any material added to the mix to improve workability (see Paragraph 8-06 c (2)), which, in the opinion of the contracting officer, may have an injurious effect on the strength, density, and durability of the concrete, will not be permitted. Before approval of any material, the contractor will be required to submit the results of complete chemical and sieve analyses made by an acceptable testing laboratory. Subsequent tests will be made of samples taken by the contracting officer from the supply of the material being used on the work to determine whether it is uniform in quality with that approved.

b. The material added shall be pozzuolanic, cementitious or silicious. It shall not contain effective early-heat-producing elements or compounds, such as those contained in Portland cement, nor shall its use result in a material increase in the free-lime content of the concrete. It shall also be in conformity with the following requirements:

Free moisture - a total of not more than 3 percent by weight.

Passing #30 sieve - not less than 100 percent by weight.

Passing #200 sieve - not less than 85 percent by weight.

8-09. Water. - The water used in mixing concrete shall be fresh, clean and free from injurious amounts of oil, acid, alkali, or organic matter.

8-10. Storage. - a. Cement. - Immediately upon receipt, at the site of the work, cement shall be stored in a thoroughly dry, weathertight, and properly ventilated building with adequate provisions for the prevention of the absorption of moisture. The building shall be of adequate capacity to provide for the requirements of delivery and construction schedules. Storage shall be such as to permit easy access for inspection and definite identification of each shipment.

b. Aggregates. - The fine and coarse aggregates shall be stored separately (see Paragraph 8-07 c (2)) and in such manner as to avoid the inclusion of any foreign material in the concrete. Stockpiles of coarse aggregates shall be built in horizontal layers to avoid segregation.

8-11. Sampling and testing aggregates. - Except where provided otherwise by these specifications, all sampling and testing of aggregates shall be made in accordance with the Federal Specifications. Unless specified otherwise, all test samples shall be taken under the supervision of the contracting officer and supplied to the Central Concrete Laboratory, West Point, N. Y., by the contractor at his expense. The source from which concrete aggregates are to be obtained shall be selected by the contractor well in advance of the time when they will be required in the work, and suitable samples as they are to be used in the concrete shall be furnished to the contracting officer at least 40 days in advance of the time when the placing of the concrete is expected to begin. The contractor shall obtain fine and coarse aggregates for concrete from approved sources.

PROPORTIONING, MIXING AND PLACING

8-12. Proportioning. - a. Basis. - All concrete materials will be proportioned so as to produce a workable mixture in which the water content will not exceed the maximum specified.

b. Control. - The exact proportions of all materials entering into the concrete shall be as directed by the contracting officer. The contractor shall provide all equipment necessary to positively determine and control the actual amounts of all materials entering into the concrete. The proportions will be changed whenever in the opinion of the contracting officer, such change becomes necessary to obtain the specified strength and the desired density, uniformity and workability, and the contractor will not be compensated because of such changes.

c. Measurement. - All materials shall be measured by weight except that water may be measured by volume when so authorized by the contracting officer. One bag of cement will be considered as 94 pounds in weight and 1 gallon of water as 8.33 pounds.

d. Cement content. - Each cubic yard of concrete shall contain not less than the quantity of cement stated below:

Class "A" - 5.0 bags or 470 pounds.

Class "B" - 4.0 bags or 376 pounds.

For concrete deposited in water, the minimum cement content shall be 6.5 bags or 611 pounds to each cubic yard of concrete in place.

e. Water content. - (1) In calculating the total water content in any mix the amount of moisture carried on the surface of the aggregate particles shall be included. The total water content for a bag of cement for each batch of concrete shall not exceed the following:

Class "A" - 5.5 gallons or 45.8 pounds.

Class "B" - 6.5 gallons or 54.1 pounds.

In all cases, however, the amount of water to be used shall be the minimum amount necessary to produce a plastic mixture of the strength specified and of the desired density, uniformity and workability. In general, the consistency of any mix shall be that required for the specific placing conditions and methods of placement, and ordinarily the slump shall be between 1 inch and 3 inches when tested in accordance with the current specifications for "Method of Test for Consistency of Portland Cement Concrete," of the American Society for Testing Materials.

(2) An increase in the maximum water content, based only on the requirements of materials added in accordance with Paragraph 8-06 c to improve workability will not be permitted unless comparative tests under job conditions show conclusively that such increase in water content will not result in a decrease in concrete strength and provided further that such increase does not exceed 1 gallon per cubic yard.

f. Aggregate content. - The total volume of aggregate to be used in each cubic yard of concrete shall be that necessary to produce a dense mixture of the required workability as determined by the contracting officer.

8-13. Mixing and placing. - a. Equipment. - Concrete shall be mixed in approved mechanical mixers of a rotating drum type, except that if permitted, relatively small quantities may be mixed by hand in a satisfactory manner. Concrete shall be mixed at all times by competent and experienced men. The contractor shall provide at the site of the work, a modern and dependable batch type mixing plant with a minimum capacity of 100 cubic yards of concrete per 8 hours. If approved by the contracting officer, the contractor may use ready mixed concrete delivered in standard truck mixing equipment of approved capacity. The equipment shall provide adequate facilities for the ac-

curate measurement and control of all materials and for readily changing the proportion of materials to conform to the varying conditions of the work in order to produce concrete of the required uniform strength and durability.

b. Time. - The minimum time for mixing each batch, after all materials are in the mixer, shall be as follows:

3/4 to 1-1/2 cu. yd. mixer	1-1/2 minutes
Larger than 1-1/2 cu. yd. mixer	2 minutes

The mixer shall revolve a minimum of 12 revolutions after all materials have been placed in it, and at a uniform speed. Neither speed nor volume capacity of the mixer shall exceed those recommended by the manufacturer. Excessive overmixing, requiring additions of water to preserve the required consistency, will not be permitted.

c. Conveying. - Concrete shall be conveyed from mixer to forms as rapidly as practicable, by methods which will prevent segregation or loss of ingredients. It shall be deposited as nearly as practicable in its final position. Conveying of concrete by means of chutes will not be permitted except for short chutes in the forms to distribute the concrete. Chutes used shall be such that the concrete slides in them and does not flow. Chutes with a flatter slope than 1 on 2 will not be permitted. There shall be no free vertical drop greater than 5 feet except where specifically authorized by the contracting officer.

d. Placing. - (1) Concrete shall be placed before initial set has occurred, and in no event after it has contained its water content for more than 45 minutes.

(2) Unless otherwise specified, all concrete shall be placed in the dry upon clean, damp surfaces, free from ice, frost or running water, and never upon soft mud, dry porous earth, or upon fills that have not been subjected to approved rolling, puddling or tamping so that ultimate settlement has occurred.

(3) Rock surfaces upon which concrete is placed shall be approximately horizontal or stepped. The surface shall be rough, and free from loose material or other matter interfering with a satisfactory bond. The rock shall be washed, scrubbed with steel brushes or brooms, and spread with a layer of mortar about 1/2 inch thick, immediately before the concrete is placed. The mortar shall be of the same cement-sand ratio as used in the concrete.

(4) All monoliths shall be of the dimensions shown on the drawings.

(5) All concrete shall be deposited in approximately

horizontal layers not to exceed 24 inches in thickness, unless otherwise specifically authorized or directed by the contracting officer and the concreting shall be carried on as a continuous operation, as far as practicable, until the placing in the course, section, panel or monolith is completed. Unless otherwise shown on the drawings, courses shall generally have a minimum thickness of 4 feet, and a maximum of 18 feet, except that in hot weather the contracting officer may direct the maximum be reduced to 8 feet. A minimum time interval of 48 hours shall be allowed between successive courses for the dissipation of heat hydration. In walls of buildings, courses including door or window openings shall terminate at the tops of the openings.

(6) Concrete shall be placed with the aid of mechanical vibrating equipment as approved by the contracting officer. Vibration shall be transmitted directly to the concrete unless otherwise directed by the contracting officer. The frequency of vibration shall be not less than 5000 per minute. The intensity of vibration shall be sufficient to cause flow or settlement of the concrete into place. The vibration shall be of sufficient duration to accomplish thorough compaction as approved by the contracting officer. External vibration may be used for thin sections where internal vibration would be impracticable. Vibration shall be supplemented by forking or spading by hand, adjacent to the forms on exposed faces in order to secure smooth, dense, even surfaces. The concrete shall be compacted and worked in an approved manner into all corners and angles of the forms and around reinforcement and embedded fixtures.

(7) In dropping concrete through reinforcement, care shall be taken that no segregation of the coarse aggregate occurs. On flat surfaces, where the congestion of steel near the forms makes placing difficult, a mortar of the same cement-sand ratio as is used in the concrete shall be first deposited to cover the forms.

(8) All top surfaces not covered by forms and which are not to be covered by additional concrete or backfill shall be carried slightly above grade and struck off by board screed (see Paragraph 8-15), except that top surfaces of walls and piers not covered by forms and which are not to be covered by additional concrete or backfill, when poured in excess of 10 feet in height in one pour, shall be carried not less than 2 inches above the specified finished elevation and struck off by board screed.

e. Construction joints. - Vertical joints shall be formed with tongue-and-groove bonds or keys at such locations and of such shapes and dimensions as approved or directed by the contracting officer. Horizontal joints shall be formed with roughened level joints or with keys, or, where horizontal pressure is always in one direction, with steps as approved or directed by the contracting officer. Where required, dowel rods shall be used. All concrete in vertical members shall have been

in place not less than 12 hours, and longer if so directed by the contracting officer, before concrete in horizontal members resting thereon is placed. As soon as practicable after placing and immediately before placing the succeeding layers is resumed, all approximately horizontal surfaces shall be washed with a high pressure air-and-water jet, or cleaned as otherwise directed by the contracting officer. Sand shall be added to the air-and-water jet when required, to remove alkali, algae, stains, and other substances injurious to the bond. The time and method of using the jet shall be such that all laitance, scum, etc. will be removed so the partly embedded aggregate is not disturbed and is washed clean. After final cleaning and immediately before placing is resumed, the surfaces shall be wetted and spread with a layer of mortar 1/2 inch thick, thoroughly brushed in. The mortar shall be the same cement-sand ratio as the concrete. Where specified or otherwise required by the contracting officer for watertight construction, copper strips not less than 18 inches in width and weighing not less than 20 ounces per square foot, properly crimped or bent, shall be placed in the concrete to span the joint.

f. Cold weather. - Concrete shall not be placed when the ambient atmospheric temperature is below 35 degrees F., nor when the concrete is likely to be subject to freezing temperatures before final set has occurred, unless specifically authorized by the contracting officer in writing. When so authorized, the materials shall be heated in order that the temperature of the concrete, when deposited, shall be not less than 50 degrees F. nor more than 70 degrees F. All methods and equipment for heating shall be subject to the approval of the contracting officer.

g. Hot weather. - For concrete placed during the extremely warm summer months and otherwise, when directed by the contracting officer, the aggregates shall be cooled by frequent spraying in such manner as to utilize the cooling effect of evaporation. During such periods the placement schedule shall be arranged as approved by the contracting officer in such manner as to provide time for the temperature of the previously placed course to begin to recede. The mixing water shall be the coolest available at the site insofar as is practicable.

8-14. Test specimens. - a. Number. - Test specimens, to determine whether the compressive strength of the concrete is in accordance with that specified in Paragraph 8-03, will be taken by the inspector. At least 1 set of 3 specimens will be made for every major pour and in general for every 100 cubic yards of concrete placed, but in any event, a sufficient number of specimens will be taken to give a comprehensive knowledge of the concrete placed during each day in each section of the work.

b. Method. - All specimens will be taken from the concrete at the mixing plant. The specimens will be tested by the Government at the Central Concrete Laboratory, West Point, N. Y. All costs of transportation and testing of specimens will be borne by the Government.

8-15. Finishing. - a. Immediately after placement, the concrete shall be properly forked back along the face of all forms by the use of standard concrete forks or spades unless otherwise specifically authorized or directed by the contracting officer. The finished surfaces shall be free from sand streaks or other voids and the plastering over of such surfaces will not be permitted. Defective concrete shall be repaired by cutting out the unsatisfactory material, and placing new concrete which shall be formed with keys, dovetails or anchors to attach it securely to the other work. This concrete shall be drier than the usual mixture and shall be thoroughly tamped into place. All surfaces of concrete not covered by forms, that are not to be covered by additional concrete, or backfill, shall have a wood float finish without addition of mortar, and shall be true to elevations as shown on the drawings. Care shall be taken to see that all excess water is removed before making this finish. Other surfaces shall be brought to the specified finished elevation and left true and regular as approved by the contracting officer. Where considered necessary by the contracting officer, or where indicated on the drawings, joints shall be carefully made with a jointing tool. Every precaution shall be taken by the contractor to protect finished surfaces from stains or abrasions. No fire shall be permitted in direct contact with any concrete at any time. Concrete surfaces or edges likely to be injured during the construction period, shall be properly protected by leaving the forms in place, or by erecting covers satisfactory to the contracting officer.

b. Floor surfaces. - Unless otherwise specified, floors of all buildings, and other surfaces where indicated on the drawings or required by the contracting officer, shall be finished with a 1-inch monolithic sand-cement mortar surface. All water, laitance and any foreign matter shall be removed from surfaces. The topping mixture shall be spread evenly over all the base within 45 minutes after the base has been placed. The mortar shall be of 1 part cement and 2 parts approved clean coarse sand. The cement and sand shall be thoroughly mixed dry and then sufficient water shall be added to produce a medium stiff mortar. After placing, the mortar shall be floated to a true, regular surface with a wood float and steel-troweled to a smooth finish. Troweling shall be the minimum amount consistent with obtaining a smooth dense surface and shall not be done until the mortar has hardened sufficiently to prevent excess fine material from being worked to the surface.

8-16. Curing. - a. Warm weather. - All concrete shall be adequately protected from injurious action by the sun. Fresh concrete shall be protected from heavy rains, flowing water, and mechanical injury. All concrete shall be kept wet for a period of not less than 14 days by covering with water, or with an approved water-saturated covering, or by a system of perforated pipes or mechanical sprinklers, or any other approved method which will keep all surfaces continuously (not periodically) wet. Where wood forms are left in place for curing,

they shall be kept wet at all times to prevent opening at the joints and drying out of the concrete. Water for curing shall be generally clean and entirely free from any elements which in the opinion of the contracting officer might cause staining or discoloration of the concrete.

b. Cold weather. - Concrete when placed during cold weather shall be kept moist and provided with adequate protection for a period of not less than 14 days, subject to the approval of the contracting officer, so that the air in contact with the concrete will be maintained at temperatures between 50 degrees F. and 70 degrees F. for at least the first 5 days of the curing period. For massive sections, where the atmospheric temperatures are sufficiently low in the opinion of the contracting officer to cause excessively rapid cooling and contraction of the exterior surfaces, this period for maintaining the temperature of the air in contact with the concrete between 50 and 70 degrees F. shall extend over the entire curing period. Salt or other chemicals shall not be admitted into the mixture to prevent freezing.

FORMS, REINFORCEMENT AND PAYMENT

8-17. Forms. - a. Materials. - Forms shall be of wood, steel or other approved material. The sheeting for all exposed surfaces shall be tongue-and-groove lumber of uniform width unless otherwise specifically authorized. Forms of like character shall be used for similarly exposed surfaces in order to produce a uniform appearance. The type, size, shape, quality and strength of all materials of which the forms are made shall be subject to the approval of the contracting officer.

b. Construction. - Forms shall be built true to line and grade, and shall be mortar-tight and sufficiently rigid to prevent displacement or sagging between supports. Responsibility for their adequacy shall rest with the contractor. Their surfaces shall be smooth and free from irregularities, dents, sags, or holes when used for permanently exposed faces. Bolts and rods used for internal ties shall be so arranged that, when the forms are removed, all metal will be not less than 2 inches from any concrete surfaces. Wire ties will not be permitted where the concrete surface will be exposed to weathering and discoloration will be objectionable. All forms shall be so constructed that they can be removed without hammering or prying against the concrete. Unless otherwise indicated, suitable moldings shall be placed to bevel or round exposed edges, at expansion joints or any other points as may be required by the contracting officer.

c. Coating. - Prior to the placing of steel reinforcement or concrete, forms for exposed surfaces shall be coated with a non-staining mineral oil. Forms for unexposed surfaces may be thoroughly wetted in lieu of oiling, immediately before the placing of concrete, except that in freezing weather oil shall be used.

d. Removal. - Forms shall not be removed without the approval of the contracting officer, and all removal shall be accomplished in such manner as will prevent injury to the concrete. Forms shall not be removed before the expiration of the minimum number of days indicated below, except when specifically authorized by the contracting officer. When, in the opinion of the contracting officer, conditions on the work are such as to justify it, forms may be required to remain in place for longer periods.

Arches, beams and slabs	14 days
Columns	7 days
Walls and vertical faces	2 days

e. Form lining for buildings. - In addition to the requirements for work specified above, the forms for walls of buildings which will be visible in the finished structures shall be lined with plywood or with pressed wood sheets, "Masonite" or approved equal. Lining shall be applied directly to the sheeting. Forms for windows and door jambs, and their flat or arched soffits, shall be lined also and the corner intersections chamfered. Jointing of the lining shall be neat and close and no patch pieces, cleats or blocking will be permitted. Overrun of lining shall be trimmed to secure proper fit to adjoining surfaces. Lining with bruises, imprints or hammer marks shall not be used.

8-18. Furnishing, bending, and placing steel reinforcement (Item 17). - a. Work included. - (1) The contractor shall furnish, cut, bend and build into the concrete, in accordance with the drawings prepared by him and approved by the contracting officer (see Paragraph 8-21 c), all steel reinforcement of deformed bars, dowels or anchors, or any other plain steel for similar purposes. Materials shall be as specified in Paragraph 11-02 a (24).

(2) Steel reinforcement may be cut and bent at the mill or in the field. All bending shall be in accordance with standard approved practice and by approved machine methods.

b. Placing.-(1) All steel reinforcement shall be placed in the exact positions and with the spacing shown on the drawings or ordered, and it shall be so fastened in position as to prevent its becoming displaced during the placing of the concrete. The clear distance between parallel rods shall be not less than one and one-half times the diameter of round rods, or twice the side dimensions of square rods, and unless specifically authorized, shall in no case be less than 1 inch.

(2) Except where otherwise indicated, steel reinforcement shall be placed as follows:

(a) All main reinforcement shall be placed not less than 3 inches from any surface, except in slabs and in buildings.

(b) All main reinforcement in walls and slabs exposed to the weather and in fire-resistant construction, shall be placed not less than 1-1/2 inches from the surface in walls and slabs, 2 inches in floor beams and 2 inches in girders and columns. The covering of stirrups, spacer rods, and similar secondary reinforcement may be reduced by the diameter of such rods. The above dimensions shall be measured from the face of the reinforcement to the face of the forms.

(c) Where splices in reinforcement, in addition to those indicated, are necessary, there shall be sufficient lap to transfer the stress by bond as may be directed. Rods shall be lapped not less than 40 diameters and splices shall be staggered. The lapped ends of rods shall be separated sufficiently or connected properly to develop the full strength of rod.

c. Protection. - Steel reinforcement shall be new unrusted stock, free from loose scale. It shall be at all times satisfactorily protected from moisture until placed in final position. Ends of rods that are to be left projecting for a considerable time shall be protected from corrosion by heavy wrappings of burlap saturated with bituminous material.

8-19. Embedded items. - In addition to steel reinforcement, there shall be built into, or set, or attached to the concrete, pipes, and manhole frames and covers, and other metal objects as shown on the drawings or ordered. All necessary precautions shall be taken to prevent these objects from being displaced, broken or deformed. Before placing concrete, care shall be taken to determine that any embedded or wood parts are firmly and securely fastened in place as indicated. They shall be thoroughly clean and free from paint or other coating, rust, scale, oil, or any foreign matter. The embedding of wood in concrete shall be avoided whenever possible, metal being used instead. The concrete shall be packed tightly around pipes and other metal work so as to prevent leakage and secure perfect adhesion. Drains shall be adequately protected from intrusion of concrete into them. Payment for this work is included in the several items for drains and metal work.

8-20. Expansion and contraction joints. - Expansion and contraction joints shall be constructed at such points and of such dimensions as may be indicated or required. The method and materials used shall be subject to the approval of the contracting officer and the materials shall conform to Federal Specifications wherever applicable. Unless otherwise indicated on the drawings, or required by the contracting officer, expansion joints shall be made by coating concrete surfaces with two coats of approved asphaltic emulsion or a single coat of bituminous cement to which premoulded sponge rubber or compressed cork filler 1/2-inch thick shall be applied and such filler thoroughly covered with asphaltic emulsion or bituminous cement as specified above. In no case shall corner protection angles or other fixed metal embedded in the surface of the concrete and bonded, be continuous through an expansion joint.

8-21. Measurement and payment. - a. Portland cement (Item 14). - (1) The quantity to be paid for under Item 14 will be the number of barrels of cement used in all parts of the work unless specifically excepted. For purposes of payment, a barrel of cement shall be considered 376 pounds net of cement. The contract unit price for the cement shall include payment for all expenses incidental to delivering the cement upon the work in which it is to be used.

(2) All cement furnished for concrete work to be done under the contract will be paid for at the contract unit price for Item 14, "Cement", except that the cement used for mortar and grout in pipe joints and other features will be included in the payment for such work.

b. Concrete (Items 15 and 16). - See Section IX.

c. Steel reinforcement (Item 17). - (1) The contractor shall furnish detail drawings and bending schedules of steel reinforcement for approval. The drawings furnished by the contractor shall be in accordance with the provisions of Paragraph 1-04 c.

(2) The quantity to be paid for under Item 17 will be the number of pounds of steel placed in accordance with the drawings or as directed by the contracting officer, measured as specified. It will not include any waste material due to the fact that the lengths supplied are too long for their purpose. The quantity to be paid for will, however, include extra metal in laps, where authorized, due to the fact that single bars would be unreasonably long. In computing the weights, the theoretical weight of plain bars will be used as tabulated in Federal Specification QQ-B-71a for the lengths placed as required. Wire or metal clips, and other supports necessary to hold the steel in place will not be considered as reinforcement but shall be furnished by the contractor without additional compensation. The contract unit price for Item 17, "Steel Reinforcement", shall include furnishing, bending, cutting, placing, fastening in position, coating and protecting the reinforcement, and all other work and materials connected therewith. (See Paragraph 8-18 a).

(3) Partial payments up to 50 percent of the contract price will be made for all steel reinforcement delivered to the site of the work provided the quality of such material is satisfactory to the contracting officer, but in no case will the payment to the contractor exceed the cost of the material delivered to the site of the work. The material shall be stored and kept protected from deterioration in a manner satisfactory to the contracting officer. If any steel reinforcement stored and partly paid for is not kept protected, no further partial payments will be made and the material will be protected by the contracting officer at the expense of the contractor.

8-22. Cinder concrete. - a. Where concrete is indicated as a filler in the roof of the pumping station, it shall be mixed in the

approximate proportion of 4 bags of cement to 8 cubic feet of sand and 16 cubic feet of cinders, mixed as required by the contracting officer. Test blocks of concrete shall be made by and at the expense of the contractor before the concrete is placed, to determine the correct proportions of the ingredients to obtain a cinder concrete of proper qualities for nailing and permanently supporting the roof surfacing. The cement and sand shall conform to the requirements for regular concrete herein. The cinders shall be coarse, clean and free from dust. The top surface of the concrete shall be given a smooth and even finish, and have a uniform slope to the gutters.

b. If so elected by the contractor and approved by the contracting officer, a substitute for cinders may be used. Any such substitute must be a commercial product of proven quality, prepared especially as a roof filler. When mixed and used as recommended by the manufacturer, the resulting product must have strength and nailing properties equivalent to that of cinder concrete and its unit weight shall not be in excess of that of cinder concrete of equivalent quality.

c. Payment for cinder concrete will be included in the payment for Item 18, "Pumping Station Superstructure" (see Paragraph 10-15).

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SECTION IX. CONCRETE STRUCTURES (Items 15 and 16).

9-01. General. - a. Description. - Concrete structures shall be constructed as shown on the drawings and in accordance with modifications designated by the contracting officer. Concrete shall conform to all the requirements of Section VIII for concrete of the class specified. Surfaces of concrete shall be finished as specified in Paragraph 8-15, except as otherwise specified in this section or indicated on the drawings. In all concrete walls, vertical construction joints shall be provided for and spaced not to exceed 30 feet apart.

b. Measurement and payment. - The quantity to be paid for under Items 15 and 16, will be the number of cubic yards of concrete satisfactorily placed within the required limits. No deductions shall be made for openings having a cross-sectional area less than that of a 12-inch pipe, nor for the space occupied by reinforcing steel, miscellaneous metal, wood nailing strips, or by other materials required to be built into the concrete. The contract unit prices shall include payment for all costs of furnishing materials, erecting and removing forms, mixing and placing concrete, and furnishing and installing expansion joint material, except that cement, reinforcing steel and other metal work are included under other items. (See Paragraph 8-21).

9-02. Class "A" concrete (Item 15). - a. Description. - This classification includes the Class "A" concrete, with 2-inch maximum size aggregate, for the conduit, pumping station, gate, and miscellaneous structures, placed between the limiting lines and grades as shown on the drawings or directed by the contracting officer. Forms for surfaces exposed to view shall be constructed in accordance with the provisions of Paragraph 8-17. Concrete fins formed on exposed surfaces shall be removed after the forms are stripped. Pipe drains and miscellaneous metal work shall be installed as provided for on the drawings. Any grouting of metal work shall be included as part of the concrete.

b. Measurement and payment. - The volume of concrete to be paid for will be the volume computed between the limiting lines and grades, as shown on the drawings or directed by the contracting officer. Payment will be made at the contract unit price for Item 15 "Concrete-Class 'A'."

9-03. Class "B" concrete (Item 16). - a. Description. - This classification includes the Class "B" concrete for pumping station foundation floor and manhole bases, as shown on the drawings or directed by the contracting officer. Piping and miscellaneous metal work shall be set and concreted in place as provided for on the drawings.

b. Measurement and payment. - The volume of concrete to be paid for will be the volume computed between the limiting lines and grades, as shown on the drawings or directed by the contracting officer. Payment will be made at the contract unit price for Item 16, "Concrete-Class 'B'."

SECTION X. PUMPING STATION SUPERSTRUCTURE (Item 18).

10-01. Work included. - The contractor shall furnish all labor, equipment and materials, except the plaque furnished by the Government (see Paragraph 10-14 b), and shall construct and complete, in accordance with the specifications and the drawings, one (1) pumping station superstructure. Item 18 shall include all work incidental to the construction of the pumping station superstructure except the furnishing and installation of such equipment as is specifically included in other items of the contract and the concrete work below Elevation 62.5 which will be paid for under Items 15 and 16. The work includes the concrete and reinforcing steel in the roof slab, the structural steel, consisting essentially of columns, roof beams and crane beams and rails, brick, glass-block and stone masonry, doors, door frames, louvres, builders' hardware, roofing, painting and other work included in the construction of the pumping station superstructure.

10-02. Structural steel. - a. All structural steel shapes, plates, bars, and their products shall conform to the requirements of Federal Specification QQ-S-711a for Structural Steel. The fabrication and erection of all structural steel shall conform to the requirements of the current American Institute of Steel Construction Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings.

b. Drawings for approval. - Before commencing fabrication, the contractor shall submit to the contracting officer for approval complete shop details in accordance with Paragraph 1-04.

10-03. Brick masonry. - a. Brick. - All brick shall be whole, sound, straight, hard, uniform in structure, with true, even faces and sharp edges; and shall be uniform in size for their respective kinds. The outside of the building shall be red face brick equal to "Washington Colonials" of the Hydraulic Press Brick Company, St. Louis, Missouri. The interior of the building and brick for backing up shall be best quality "hard" grade sand-lime brick, size 2-1/4 by 3-3/4 by 8 inches, conforming to the requirements of Federal Specification SS-B-681. The contractor shall submit to the contracting officer, for approval, samples of all brick he proposes to use.

b. Mortar. - Mortar shall be composed of one part Portland cement, one-half part lime putty, and three part sand by volume. Mortar shall be thoroughly mixed either by hand or in a mechanical batch mixer, and only in such quantities that it can be used completely before it has attained its initial set. The use of a continuous mixer or of re-tempered mortar will not be permitted. Only enough water shall be used to make a workable mix. All sand shall conform to the requirements of Paragraph 8-06 for fine aggregate and shall pass a No. 8 standard sieve. Sand used for the mortar for face brick shall be a natural white or clear sand approved by the contracting officer. Lime shall conform to Federal Specification SS-L-351 for Type "M" Hydrated Lime. Cement shall be

Portlant cement conforming to the requirements of Paragraph 8-05.

c. Laying brick. - (1) All brick masonry shall be accurately laid in courses as indicated on the drawings. All exposed surfaces shall be laid to lines that are plumb, true, straight, and level. Each brick shall be laid in a full bed of mortar and shall be shoved into place in the mortar, making joints that are full without subsequent flushing or filling. Except where otherwise indicated on the drawings, the brick course including mortar joint shall be 2-5/8 inches high. Vertical and horizontal mortar joints shall have the same thickness. The mortar joints of exposed face and sand-lime brickwork shall be neatly underhand struck. Except where otherwise indicated, all exposed faces of brickwork shall be laid in common bond, with stretchers bonded every sixth course by a course of headers. Metal wall ties shall not be used for the bonding of brickwork, except where indicated on the drawings or authorized by the contracting officer. Care shall be taken to insure the weather-tightness of the brick masonry to its concrete foundation. The waterproofing membrane shown on the drawings at the foundation of the brick walls shall be similar or equal to the preformed waterproofing units manufactured by Sandell Manufacturing Corporation, 70 Phillips Street, Watertown, Massachusetts, or to the Wasco copper-fabric flashing, Type No. 2, Wasco Flashing Company, Cambridge, Massachusetts.

(2) The courses shall be laid to correspond exactly in height with the heads of doors and other openings without any cutting or chipping of the brick. Door frames and all other fixtures shall be built into the brickwork as it is laid. Brick masonry around window and door openings shall have jambs built true and plumb with the reveals at right angles and of the depth shown on the drawings; and the brickwork shall either be kept back a sufficient distance or raked out to permit a caulked joint as indicated on the drawings. The filling in or backing brickwork shall be kept level with the facing and each piece of facing material shall be backed up solid with brick and mortar so as to make a perfectly bonded homogeneous mass between wall lines. All walls shall be carried up together as nearly as possible on the same level. If during construction, the walls become displaced, damaged, or marred, by the contractor or his workmen, the contractor shall without additional compensation, execute all patching and repairing necessary to leave the entire work in perfect condition. The placing of put-logs in masonry walls is prohibited. The contractor shall place boards over all window sills and projecting stone or water tables during construction.

(3) Care must be taken that the tops of all unfinished work are thoroughly covered or protected against inclement weather, by means of waterproof canvas and boards. Bricks laid in warm weather shall be kept wet before laying and shall be wet when laid. Bricks laid in cold weather shall be laid dry and warm. In winter the brick, sand, water, and other material shall be kept warm and if required by the contracting officer, shall be heated by steam pipes or other approved methods in order that the work shall proceed properly. The brickwork shall be carefully covered and protected to prevent freezing.

(4) The contractor shall carefully set or build in all door frames, wall plates, anchors, beams, bolts, or other iron work; bronze, or other incidental materials; and shall build all recesses and pipe chases, as indicated on the drawings, or directed by the contracting officer.

(5) After completion, all brickwork shall be cleaned and pointed where necessary. Before pointing, the joints shall be raked out, cleaned and well moistened. The caulking around all door and window frames shall be carefully checked, and the joints recaulked where necessary.

(6) The dimensions of the brickwork shown on the drawings may be varied slightly depending on the size of the brick used.

10-04. Glass block. - a. Glass block panels shall be installed as shown on the drawings. The blocks shall have a light transmission of not less than 70 percent of the incident light. The glass block shall be hollow, partially evacuated, water clear units of pressed glass construction of the best quality, similar and equal to the units manufactured by the Owens-Illinois Glass Company, Toledo, Ohio, or the Pittsburgh Plate Glass Company, Pittsburgh, Pennsylvania. Unless otherwise shown on the drawings, all glass block shall have a standard size of 11-3/4 by 11-3/4 by 3-7/8 inches. A sample of the type of glass block the contractor proposes to furnish shall be submitted for the approval of the contracting officer.

b. Laying of block. - (1) Each block shall be set in a 3/16-inch to 1/4-inch layer of mortar composed of one part Portland cement, one part lime, and four parts sand by volume. The sand used in the mortar shall conform in quality to that specified for concrete and the maximum size shall not exceed that passing a No. 8 standard mesh screen. Glass blocks shall be laid true to line and grade. Both head and bed joints shall be filled completely with mortar; after the mortar has reached its initial set, the joints on both surfaces shall be compressed and pointed with a metal pointing tool, leaving the finished surface of the joint smooth and non-porous. Blocks shall not be cleaned until after mortar has reached its final set.

(2) Horizontal mortar joints shall be reinforced with continuous 20-gauge perforated metal wall ties 2-3/8 inches wide or with wire wall ties of approved type and of a length suitable for the glass block panel, galvanized after forming. Ties shall run continuously by lapping 6 inches at ends; they shall be placed every course and shall not extend into brick masonry or pierce expansion joints.

(3) Expansion joints shall be provided at the head and jambs of all glass block panels, and all joints at head and jamb of panels shall be kept free from mortar and free from the transmission of structural loads carried by adjacent masonry. Expansion joints shall have a minimum thickness of 3/4-inch and shall consist of 1/2-inch premolded

waterproof expansion joint filler and a minimum of 1/4-inch of mortar between the glass block and filler. The premolded filler shall be placed continuously on the back of the masonry "chase" at the head and jambs of the window. It shall be installed before the glass block is laid and be held in place by an adhesive such as asphalt emulsion. After the panels have been laid and the mortar has set, non-staining oakum shall be caulked between the sides of the block and the sides of the "chase" to within 1/2-inch from the finished surface. The 1/2-inch recess shall be filled flush with the finished surface with non-hardening waterproof caulking material similar and equal to "Vulcatex" manufactured by A. C. Horn Company, Long Island City, New York, or other approved elastic (or mastic) compound as shown on the drawings.

10-05. Chimney. - The chimney shall be constructed as shown on the drawings, and shall be lined with fire brick. The joints shall be well cemented and struck smooth inside. A suitable cast iron clean-out door and thimble of the size indicated on the drawings shall be set in the chimney.

10-06. Stonework. - a. All stone work shall be of cast stone, light-gray, and shall be placed as indicated on the drawings. The stone shall be uniform in color, sound, and perfect throughout; and subject to inspection before being placed in the work. All exposed surfaces shall have a rubbed finish. The cast stone shall be similar and equal to that made by the Emerson and Norris Company of Boston, Massachusetts, and shall conform in all respects to Federal Specification SS-S-721, for architectural cast stone, Type I. The contractor shall submit samples of the precast stone proposed to be used, for the approval of the contracting officer. Samples shall be not less than 8 by 12 inches. The contractor shall also submit evidence satisfactory to the contracting officer that the manufacturer who will furnish the cast stone has had at least 10 years' experience in designing and manufacturing cast stone of satisfactory appearance and durability.

b. Before purchasing the stone, the contractor shall submit, for approval of the contracting officer, prints (in quadruplicate) of drawings showing in detail the sizes, coursing, and full details of trim. (see Paragraph 1-04 c).

c. The casting, sizing, and coursing of all cast stone shall be done in accordance with the approved detail drawings. The stone shall be dressed and finished to a clean, smooth, uniform surface. Washes shall be cast or cut on the tops of copings, and drips on the undersides of projections where indicated on the drawings. All arrises shall be sharp and true. Anchors, cuts for accommodating steel work, and other incidental details shall be provided as required. Holes and sinkages shall be cast or cut in stones for all anchors, clamps, dowels, etc. Lewis holes shall be cut or cast in stones weighing more than 100 pounds. Lewis holes or other holes shall be not closer than two inches to exposed faces of stone, and holes on exposed faces of stone are prohibited. The cast stone shall be made to check in dimensions with all adjoining brickwork.

d. Mortar for setting the cast stone shall consist of one part Portland cement, three parts fine white sand, and 10 percent by volume of hydrated lime.

SETTING STONE.

e. (1) Just before setting, each stone shall be brushed clean and thoroughly drenched with clean water. The stone shall then be accurately set, by competent stone setters, true to line and level, with full flushed joints. Each stone shall rest on a full bed of mortar placed under the center of the stone; the amount of mortar being sufficient to fill all anchor holes and to fill out to the edges of the stone on all sides. All stone shall be set with 1/4-inch joints raked out at the face to a depth of one inch and left for future pointing. The backs of stone facings shall be pargeted with neat cement where shown on the drawings. Where required in connection with the setting of heavy stones and projecting courses, in order to arrest the squeezing out of mortar beds, tipping or uneven setting of the stone; and wherever required in connection with stone bedded on structural members, to prevent cracking or spalling from unequal pressure, the contractor shall provide and install lead pads or buttons. These pads or buttons shall be made of soft, sheet lead, either round or octagonal in shape, and of the same thickness as mortar joints. They shall be set not less than one inch back from the face of the stone, and have the mortar bed spread around them. Wherever practicable, heavy stones shall be set with derricks and lifted with Lewis plugs or hoisting loops. Where Lewis plugs or hoisting ropes cannot be used, the stone shall be set with clamps. The use of pinch bars, except on the embedded parts of the stones, is prohibited. No defective stones, and no broken, spalled, patched, or otherwise damaged stone shall be set in place. Rejected material shall be removed promptly from the work area.

(2) The contractor shall furnish and install all necessary anchors and dowels, as indicated on the drawings or as required by the contracting officer. Dowels shall be coated with an approved damp-proofing paint before being used.

(3) The contractor shall protect all cast-stone work from damage of every description until all construction work is completed. Any damaged work shall be replaced at the contractor's expense.

(4) After the stone has been set, all work shall be gone over by a competent stone mason, thoroughly cleaned, and all joints brushed clean, soaked with clean water, filled solid with pointing mortar, and dressed. The use of wire brushes, or acids and solutions which might cause discoloration will not be permitted in cleaning stone.

(5) The mortar for pointing stone work shall consist of one part white "Medusa" cement or equal, two parts white sand, and 10 percent by volume of hydrated lime. The mortar shall be colored as directed by the contracting officer.

10-07. Doors. - a. Doors shall be of the type and design shown on the drawings. The contractor shall submit to the contracting officer, in accordance with the provisions of Paragraph 1-04 c, shop drawings showing the details of all doors.

b. The entrance door shall be of the vertical, double-swinging, ornamental type, supported at the jambs with butts as shown on the drawings. Stiles and rails shall be constructed of rectangular steel tubing, internally reinforced at all corners and joints. All mitre joints and butt joints shall be welded and ground smooth. The metal panels shall be not less than 1/16-inch thick. The quality of the material and workmanship shall in all respects be equal to the corresponding product of the Atlantic Metal Product Co., Inc., Long Island City, New York. Bronze weather stripping as indicated on the drawings shall be equal to the product of the Chamberlin Metal Weatherstrip Company.

c. The service door shall be swinging, all steel panel, of hollow steel construction. The quality of the material and workmanship shall in all respects be equal to the tubular steel door as made by William Bayley Co., Springfield, Ohio. The boiler room door shall be swinging, all steel louvre type, the louvre to be stationary pressed as an integral part of the steel door panel, and the door furnished with pressed steel frame. The quality of the material and workmanship of the door louvre and frame shall in all respects be equal to the corresponding product of William Bayley Co., Springfield, Ohio. Bronze weather stripping as indicated on the drawings shall be equal to the product of the Chamberlin Metal Weatherstrip Company.

d. The doors shall be painted and finished at the shop in the color to be selected by the contracting officer. The doors shall be cleaned and primed with one coat of approved rust resistant paint baked on, and one coat of mineral filler shall be baked on and rubbed before assembling. The doors shall be finished with two additional coats, baked on, the last coat being of the color selected. If the paint on the doors is marred in transit or during installation, the finish shall be replaced at the contractor's expense to the satisfaction of the contracting officer.

10-08. Door frames. - The entrance and service door frames shall be made of steel, accurately fitted, welded, anchored in place and covered with copper as shown on the drawings. Loose lintels shall have not less than 6 inches bearing at each end. The boiler room door frame shall be 14 U.S.S. gauge pressed steel, with adjustable wall anchors and reinforcement for hinges. The entrance door shall have a suitable cast bronze saddle properly fitted and secured in place with expansion bolts.

10-09. Builders' hardware. - a. The contractor shall furnish and install heavy bronze hardware for all doors, including locksets, butts, chain bolts, floor and wall bumpers, clamps, stops or checks, and all other details of a complete installation. The inactive leaf of the entrance door shall have two pair butts, one long-chain bolt at top and one foot bolt. The active leaf shall have two pair butts, one lock, one foot bolt, and one door holder. Other doors shall be hung on 1-1/2 pair butts and be equipped with lock sets, door checks, and stops.

b. The hardware shall be secured in place with machine

screws and reinforcing plates shall be provided where necessary. Grouting around the foot bolt keepers in the floor shall be brought flush with the top. The hardware shall be subject to approval of the contracting officer, shall be of the heavy, solid bronze type, and of sufficient strength and size for the use intended. It shall conform to Federal Specifications FF-H series, where applicable, and shall be similar and equal to the following products of Sargent and Company, New Haven, Connecticut.

Butts, 5 x 5	-	Sargent No. 2548
Foot bolt	-	Sargent No. 1891
Chain bolt	-	Sargent No. 1883
Lock	-	Sargent No. 923
Door handle	-	Sargent No. 7923 TC
Door holder	-	Sargent No. 268

10-10. Roofing. - a. Dock. - The roof slab and beam covering shall be of concrete as indicated on the drawings and shall conform to the requirements for Class "A" concrete as specified in Section VIII. Before taking its initial set the concrete shall be struck off approximately to grade and then roughened with a broom. When directed by the contracting officer or in any event not less than 48 hours after the slab has been poured the contractor shall thoroughly clean the slab, dampen it and place a filler slab of cinder concrete to the lines and grades indicated on the drawings (see Paragraph 8-22). This slab of concrete shall be struck off and wood float finished to a surface with a reasonably smooth finish. Forms and shores under the roof slab shall not be removed or disturbed in less than 14 days after placing of the cinder concrete and then only upon specific authorization of the contracting officer.

b. The cinder concrete filler slab shall be covered with a built-up gravel roof as follows: Before the application of any roofing materials, the concrete slab shall be smooth, clean, firm, and dry. The entire surface of the slab shall then be coated uniformly with an approved asphalt primer, using not less than one gallon of primer for each 100 square feet of roof surface. Not less than 24 hours after the application of the priming coat the entire surface shall be coated uniformly with hot asphalt conforming to the Tentative Specifications for Asphalt for Use in Constructing Built-Up Roof Coverings (A.S.T.M. Designation: D 312-29T) of the American Society for Testing Materials. Into this coating, while hot, there shall be laid four layers of 15-pound, 36-inch asphalt-saturated felt over the entire surface of the roof, lapping each sheet 27-1/2 inches over the preceding one, lapping the ends of the sheets not less than 6 inches, and mopping with asphalt the full 27-1/2 inches so that in no place shall felt touch felt. The felt shall conform to Federal Specification RH-F-191 for Asphalt-Saturated Felt. At all vertical surfaces the roofing shall be carried up at least 6 inches and thoroughly mopped to the wall so that contact is obtained throughout. The layers of felt shall be laid so as to be free from wrinkles and buckles. Over the entire surface there shall be poured from a dipper a uniform coating of asphalt, into which, while hot, there shall

be embedded not less than 400 pounds of gravel per 100 square feet. Not less than 160 pounds of asphalt shall be used for constructing each 100 square feet of the completed roof and the asphalt shall be applied at a temperature of approximately 350 degrees Fahrenheit. The roofing gravel shall be hard, durable, water worn, dry, and free from clay, loam, sand, or other foreign substances. All gravel shall pass a 3/4-inch square mesh sieve, not less than 80 percent shall pass a 5/8-inch square mesh sieve and shall be retained on a 1/4-inch square mesh sieve, and 100 percent shall be retained on a 1/8-inch square mesh sieve.

10-11. Flashings. - All flashings indicated on the drawings or otherwise required shall be 16-ounce copper conforming to Federal Specification QQ-C-501, Type V. The chimney shall be flashed and counterflashed. The concrete bases for the exhaust silencers shall be flashed as shown on the drawings.

10-12. Louvres and ventilators. - Where shown on the drawings, louvres of the size indicated, shall be placed. The frame of those louvres shall be of 32-ounce and the blades of 48-ounce cold rolled copper mounted on bronze bearings. The louvre frames shall be constructed in such a manner that will assure a water-tight connection between the frame and the wall. They shall be equipped on the exterior with copper mesh screens of the size and type made by the same manufacturer who furnishes the louvres. The louvres shall be similar and equal to those manufactured by the H. H. W. Bergmann & Company, New York, New York.

The galvanized sheet metal duct for ventilating the wet sump shall be furnished and installed as shown on the drawings. Roof ventilators of the type and size shown on the drawings shall also be furnished and installed at the locations indicated. The contractor shall furnish detailed drawings for approval, showing the method of anchoring the roof ventilators in place.

10-13. Miscellaneous details. - a. The contractor shall furnish and install under Item 18, the bronze letters over the entrance door as shown on the drawings.

b. The contractor shall install under Item 18, at the location shown on the drawings, the plaque which will be furnished by the Government.

10-14. Painting. - The concrete floor of the pumping station and the side walls below the brick masonry shall be painted as specified in Paragraph 19-07. The cost of all painting shall be included in the contract price for Item 18 (see Paragraph 10-15).

10-15. Payment. - Payment for constructing and completing the pumping station superstructure in accordance with the specifications and the drawings will be made at the contract price for Item 18, "Pumping Station Superstructure."

SECTION XI. METALS AND EMBEDDED ITEMS (Items 19 to 22 incl.)

11-01. General. - All metals, unless otherwise specified, shall conform to applicable Federal Specifications, and, when not covered thereby, to applicable A.S.T.M. specifications. All castings shall have the pattern or mark number cast on them. Unless otherwise authorized by the contracting officer, the scale weights of each casting or forging after machining shall be within 5 percent of the weights as calculated from the dimensions specified or shown on the drawings. Castings shall conform, at the minimum section thereof, to the following dimensional tolerances; where embedded in concrete, to within 1/8 inch; where not embedded in concrete, to within 1/16 inch of the dimensions shown on the drawings.

11-02. Materials and workmanship. - a. The articles included in Items 19 to 22 inclusive, other miscellaneous materials, and all metals required in the work except as otherwise specified, shall meet the requirements of the following specifications where applicable to the use intended:

(1) Structural steel;- Federal Specification QQ-S-711a; shapes, plates, bars, pins and bolts shall be Class "A" and rivets shall be Class "C", unless otherwise required. Welding will be accepted only where specified or authorized, and approved only when done in accordance with the current requirements of the American Bureau of Welding.

(2) Cold-rolled steel;- A.S.T.M. Specifications A-108-36 for "Commercial Cold-Finished Bar Steels and Cold-Finished Shafting". Unless otherwise specified this material shall be used for rods, pins, keys, and similar parts.

(3) Hot-rolled steel, for shafting, sleeves and rollers;- A.S.T.M. Specifications A-107-36 for "Commercial Quality Hot-rolled Bar Steels."

(4) Machine steel;- same as for Hot-rolled steel.

(5) Steel, corrosion resisting;- Federal Specifications QQ-S-763 or 766.

(6) Steel forgings, shall be of hot-rolled open-hearth steel forging bars conforming to A.S.T.M. Specifications A-18-30 for carbon steel and alloy steel forgings, Class "C", except that shafts of this material not otherwise specified shall be S.A.E. No. 1045 hot-rolled, open-hearth steel forging bars.

(7) Steel castings;- Federal Specification QQ-S-681a.

(8) Iron castings, gray;- Federal Specification QQ-I-652.

class as indicated. Tensile tests and chemical analysis will not be required.

(9) Malleable iron castings;- Federal Specification QQ-I-666, Type "A".

(10) Steel rail track and fittings, shall be standard A.S.C.E. sections and shall conform to the A.R.E.A. standard specification for carbon steel rails.

(11) Chains and attachments;- Federal Specification RR-C-271 of Type "A" and Grade "2" unless otherwise specified.

(12) Bolts, screws, and washers;- Federal Specification FF-B-571a and current standard practice, unless otherwise specified.

(13) Wrought iron bars and shapes;- Federal Specification QQ-I-686, Grade "B".

(14) Wrought iron pipe;- Federal Specification WW-P-441.

(15) Cast iron pipe;- A.S.T.M. Specifications A-44-04, Class "A"; for soil pipe refer to Federal Specification WW-P-401.

(16) Black steel pipe and fittings;- Federal Specification WW-P-403, Type "A", and WW-P-521.

(17) Sheet copper;- Federal Specification QQ-C-501, Type "V", Class "A".

(18) Zinc coatings (hot galvanized);- Federal Specification QQ-I-696.

(19) Babbitt metal;- Federal Specification QQ-M-161.

(20) Classes C and D bronze for slide gate seats shall have the following chemical properties:

	Class C	Class D
Copper (percent)	82.00 to 83.00	82.00 to 83.00
Tin (")	6.75 to 7.50	4.75 to 5.50
Lead (")	4.50 to 5.00	7.75 to 8.25
Zinc (")	5.00 to 6.00	4.00 to 5.00

(21) Lead;- Federal Specification QQ-L-171, Grade A.

(22) Solder;- Federal Specification QQ-S-551.

(23). Valves;- Federal Specification WW-V-76a.

(24) Steel reinforcement shall be of new billet intermediate grade, open-hearth steel, deformed, and shall conform to the Federal Specification QQ-B-71a for "Bars, reinforcement, concrete, Type "B", Grade 2 (dated January 12, 1938)." Certified copies of any mill test required shall be furnished by the contractor and the steel shall be subjected to such tests as the contracting officer may consider necessary to establish its quality, including particularly the requirements of bending and elongation. The steel shall be free from oil, paint, dirt or excessive rust.

Expanded metal reinforcement shall be used as shown on the drawings in the fire-proofing of steel beams. This reinforcement shall consist of a diamond shaped steel mesh manufactured from open-hearth steel, by a cold drawn process which will cut and draw the material so that uniform strands are formed at regular intervals along the length of the sheet with the plate intact between successive strands. It shall possess ductile properties which will permit any strands to be bent through an angle of 180 degrees over one diameter, without fracture, and to have a yield point of not less than 55,000 pounds per square inch. The size of the diamond shall be approximately 1-1/2 inches by 3 inches, and the weight per square yard shall be not less than 1.8 pounds.

b. Other items, unless otherwise specified, shall conform to current standard practice for the material required and use intended.

11-03. Galvanizing and painting. - a. Galvanized iron or steel articles shall be galvanized by the hot-dip process unless otherwise permitted. Injuries to the galvanizing shall be satisfactorily repaired. Provision shall be made for protecting threads either by counter-boring fittings, so as to cover threads or by cutting threads so as to make a very loose fit before galvanizing and carefully re-running threads after galvanizing so as to leave a good coating all over threads. Hot galvanizing shall be of such quality as to endure at least 4 one-minute immersions in copper sulphate solution, in accordance with the requirements of the Preece test.

b. Except as otherwise specified all metal to be exposed in the finished work shall be thoroughly cleaned and then thoroughly and evenly painted in accordance with the provisions of Section XIX.

11-04. Miscellaneous iron and steel (Item 19). - a. Manhole and other frames, ladders, manhole steps, steel in service bridge, stair treads, and other miscellaneous iron and steel items as shown on the drawings shall be furnished and installed.

b. Payment will be made as specified in Paragraph 11-08.

11-05. Miscellaneous pipe and fittings (Item 20). - a. Black steel or standard wrought iron pipe complete with malleable iron fittings and connections shall be furnished and installed on the structures where shown on the drawings. Pipe shall be of the size as shown on the drawings and shall conform to Federal Specifications WW-P-403 and WW-P-521. Pipe fittings and connections shall be malleable ball pattern and pin-connected where required; post connections at the floor, and caps used on the

bottoms of sleeves embedded in the concrete shall be standard screw type. All fittings shall be Crane Company type or equal. Floor or wall flanges of screw type in the pumping station shall be anchored into the concrete with stud type expansion bolts consisting of one primary and one secondary expansive unit similar and equal to that manufactured by Akerman Johnson Company.

b. Payment will be made as specified in Paragraph 11-08.

11-06. Copper water stops. (Item 21). - a. Copper water stops required for the construction joints and expansion joints of concrete work shall be furnished and installed. Copper water stops used in concrete expansion and construction joints shall be continuous, and shall be crimped for expansion joints only. Splicing of the water stops shall be done by overlapping, riveting and soldering, or brazing. Unless otherwise specified on the drawings the material shall be 20-ounce sheet copper of approved standard. At expansion joints the crimp shall be filled with a mastic filler of "elastite" or equal as manufactured by Philip Carey Company, Cincinnati, Ohio. Copper water stops shall be placed in the expansion joints indicated on the drawings.

b. Payment will be made as specified in Paragraph 11-08.

11-07. Steel trash racks (Item 22). - a. Steel trash racks complete, including frames, angle iron guards, hoisting winches and accessories shall be furnished and installed as shown on the drawings. The steel trash racks, nuts, bolts, rivets, and pipe spacers shall conform to the requirements of Federal Specification QQ-S-711a; shapes, plates, bars, and bolts shall be Class "A" and rivets shall be Class "C", unless otherwise shown. All frames and guards to be attached to the concrete shall have anchors as shown on the drawings or as directed. The steel shall be painted as provided in Paragraph 19-03.

b. Each trash rack shall be raised and lowered by a hand-operated hoisting winch of two-ton capacity. The hand crank shall be detachable. The hoisting winches shall be similar and equal to the "2-ton Lightweight" as manufactured by Beebe Brothers, Inc. of Seattle, Washington. The hoists shall be enclosed in a galvanized sheet iron hood for protection against the weather.

c. Payment will be made at the contract price for Item 22, "Steel Trash Racks," and shall include all costs of furnishing and installing the trash racks complete with frames, guards, hoisting winches and accessories as specified.

11-08. Measurement and payment. - a. The quantities to be paid for under Items 19 to 21, inclusive, will be the number of pounds respectively furnished and installed in accordance with the drawings and specifications. Wherever practicable, the quantities shall be determined by weighing the articles and materials. When weighing is not practicable, the actual weight of each part or item involved will be determined by

the contracting officer, who will use for that purpose manufacturers' weights, catalog weights, and computed weights. The weight of all tare, packing and blocking will be deducted, using only net weights for payment quantities; provided, that no payment will be made for any weight in excess of 5 percent more than the computed weight as determined from the drawings.

b. In calculating computed weights the following unit weights of the several materials will be used unless otherwise specified:

Structural Steel	- 0.2833 pounds per cubic inch.
Cast Iron	- 0.2604 " " " "
Wrought Iron Pipe	- The weight per linear foot shown in Table I of Federal Specification WW-P-441.
Black Steel Pipe	- The weight per linear foot shown in Table I of Federal Specification WW-P-403.
Copper Water Stops	- 20 ounces per square foot.

c. Payment will be made at the applicable contract unit prices for Items 19 to 21 inclusive (see Paragraph 1-05).

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SECTION XII. SLUICE GATES, COMPLETE WITH HOISTS (Item 23).

12-01. Work included. - a. The contractor shall design, furnish and install one electric motor-operated seating pressure sluice gate, one hand-operated seating pressure sluice gate, and one electric motor-operated unseating pressure sluice gate as shown on the drawings, complete with hoists and accessories, all in accordance with the drawings and the specifications.

b. The contractor shall design, furnish and install a removable sheet metal housing for each gate hoist. The housing shall be constructed to slide down over the hoist and be secured in place, and shall be equipped with a door furnished with a lock to provide access to the motor control.

12-02. Description. - a. The gates shall be of cast iron with bronze seals, and shall be designed to operate satisfactorily under all heads up to and including the maximum hydrostatic head of 35 feet at the center of the gate. The dimensions of the gate openings shall be as shown on the drawings. Each gate shall be operated by means of a rising-stem hoist. Each gate shall seat or unseat satisfactorily under the maximum hydrostatic head. When seated the gates shall be practically water-tight.

b. The leaf of each gate shall consist of a rectangular cast iron plate with horizontal and vertical ribs. Bronze seat facings shall be driven into dovetail grooves machined in the face of the gates. The leaf shall have a pocket cast in the center near the top, heavily reinforced by ribs into which shall be fitted a solid manganese bronze thrust nut threaded and keyed to the stem. This thrust nut provides the attachment between the stem and the leaf and shall be of ample size to take the thrust both ways.

12-03. Seating pressure gate. - a. Leaf. - The leaf of the seating pressure gate shall conform to all the requirements of Paragraph 12-02 b. and in addition the leaf shall have tongues on each side extending the full length of the leaf and these tongues shall be accurately machined all over. The leaf shall be not less than one inch thick and shall be suitably reinforced with horizontal and vertical ribs.

b. Frames and guides. - (1) The gate frame for the seating pressure gate shall be of the standard flat type having the rear face machined and drilled to attach to concrete and the front face machined to take the sluice gate guides. The frames shall be of cast iron of ample section to prevent distortion and shall be cast in one piece. Bronze seat facings shall be driven into dovetail grooves machined in the front face of the frame.

(2) The guides for the seating pressure gate shall be

of cast iron of sufficient length so that not less than one-half of the gate is within the guides when the gate is fully open. Slots shall be machined the full length of the guides, of such dimensions, that there is not over 1/16-inch clearance with the tongues on the side of the leaf. The guides shall be machined to fit the frame and shall be bolted to the frame with steel studs and keyed to the frame to prevent lateral movement. Holes for studs shall be spot faced.

12-04. Unseating pressure gate. - a. Leaf. - The unseating pressure gate leaf shall conform to all the requirements of Paragraph 12-02 b and in addition shall be fitted with four wedges on each side with two top and two bottom wedges. The leaf shall have tongues on each side extending the full length of the leaf and these tongues shall be accurately machined all over. The side wedges shall be of solid bronze and shall be of the adjustable type, and shall be provided with tongues on the back to slide in vertical keyways, machined in the leaf, and shall be secured to the leaf by shouldered steel studs and bronze nuts. They shall have solid bronze adjusting bolts. The side wedges shall be machined on all bearing surfaces and shall make accurate contact with the bronze wedge facings attached to the guides. The top and bottom wedges shall be of solid manganese bronze and shall be of the adjustable type. The wedges shall be attached to the leaf by shouldered steel studs and bronze nuts and shall have solid bronze adjusting bolts. The wedges shall be machined on all bearing surfaces and shall make accurate contact with the wedge seats attached to the frame. The leaf shall be not less than one inch thick and shall be suitably reinforced with horizontal and vertical ribs.

b. Unseating pressure gate frame and guides. - (1) The gate frame for the unseating pressure gate shall conform to all the requirements of Paragraph 12-03 b(1) except that it shall be of the standard flanged type.

(2) The guides for the unseating pressure gate shall conform to all the requirements of Paragraph 12-03 b(2) and in addition shall be reinforced with heavy ribs at points of contact with the side wedges of the leaf, capable of taking the whole thrust due to water pressure and wedging action. Heavy bronze wedge facings shall be attached to the guides at points of contact with the side wedges and these wedge facings shall be machined on all bearing surfaces and shall make accurate contact with the side wedges.

12-05. Gate stems. - a. The gates shall have rising stems of sufficient size to withstand safely, without buckling, the whole thrust due to closing the gate under the maximum operating head. The gate stems shall be cold rolled steel in sections not exceeding 10 feet in length. The sections of each stem shall be joined together by solid manganese-bronze couplings threaded and keyed to the stems.

b. Each stem shall be furnished with stem guides so that

the unsupported length of stem shall not exceed 10 feet. All stem guides shall be bronze bushed and adjustable.

12-06. Electric hoists. - a. The gate electric hoists shall be electric motor-operated, pedestal type, one for each of two gates as shown on the drawings, complete with electric motor and controls, stems, stem guides, stem pipe covers and bracing, accessories and position indicator, and shall be sufficient in capacity to raise and lower the gates against the maximum operating head.

b. Description. - (1) Two sluice gates shall be operated by an electric motor-operated hoist designed to lift the gates against a head of 35 feet. The hoists shall have a minimum stem rising and lowering speed of one foot per minute.

(2) The pedestal and gear case shall be made waterproof and shall be constructed of high grade cast iron with provisions made for attaching stem cover to top cover plate. A suitable torque plate shall be provided at the base of the pedestal. Electric contactor cases and push button cases shall be cast as integral parts of the pedestal and shall have cast iron covers with machined and gasketed water-tight and dust-tight joints.

(3) All gears shall be of steel properly designed for the service intended. The gear shafts shall be provided with bronze bushings. Gearing shall be enclosed in watertight and dust-tight casings and shall be so designed that it will not be necessary to run the gears in oil or grease. Spur gearing shall be used. The stands shall include automatic mechanical hammer-blow devices or other apparatus to allow the motor to come up to speed before unseating the gate.

(4) A handwheel with disconnecting handle, and connected to the stem by suitable gearing, shall be provided for hand operation of each hoist. The handwheels shall not revolve when the hoists are electrically operated, and the motors shall be automatically prevented from starting when the hoists are being hand-operated, or when the "hand-motor" handles are in the "hand" position.

(5) Suitable visual indicators shall be provided so that the exact position of the gates can be determined at all times.

(6) The hoists shall be equipped with stem covers of threaded wrought iron pipe with suitable caps.

c. Gate hoist electrical equipment. - (1) The hoist motor shall be mounted on the pedestal and arranged so that the controls are built in, completely enclosed and waterproof. The motor shall be direct connected through a train of spur gears and shall be the single speed, high-torque, low-starting current type. The motor shall be designed for 220-volt, 3-phase, 60-cycle current to operate at a speed of not over 900 r.p.m. It shall be of the squirrel cage hoist type,

rated for 30-minute operation and shall be equipped with all necessary starting apparatus and protective devices. The starting torque of the motors at rated voltage and frequency shall be not less than 250 percent full load torque. The motor shall be equipped with grease-packed ball-bearings and splash-proof housing. Insulation shall be impregnated with special moisture and acid-resisting compound.

(2) The controllers shall be of the full magnetic reversing type, designed for across-the-line starting; and controlled by a three-button push-button station, so that the gates may be raised, lowered, or stopped at any desired point in their travel. The controllers shall be provided with undervoltage, inverse-time-limit and instantaneous overload protection accomplished by suitable relays. Overload relays shall be of the automatic reset type. The limits of travel of the gate in both upward and downward directions shall be accurately determined by quick-break limit switches geared directly to the gate stems. The switches shall be designed to absolutely prevent "drift" or jamming of the gate. The switches shall be housed in waterproof and oil-tight cases and shall be equipped with quick-break contacts with micrometer adjustment. Each hoist shall contain a motor contactor equipped with separate "open" and "close" contactor arms, mechanically interlocked, and provided with arc shields. The contactor shall be of ample size and rating to make and break the current required by the motor under all conditions. Push buttons in watertight cases shall be provided. The push buttons shall be clearly labeled "open", "close" and "stop". A pilot light shall be installed, indicating that the motor is ready to be operated. All electrical apparatus shall be installed, and internal connections shall be made by the hoist manufacturer.

(3) Wiring shall be complete as shown on the drawings and shall be placed in suitable ducts. Wires shall be insulated with approved "slow-burning weatherproof" insulation. The wiring shall terminate at a suitable enclosed terminal board.

(4) The hoist shall have a hoisting speed with the electric motor of not less than 1 foot per minute. A gate-position indicator shall be included on the hoists. The gate-position indicator shall be plainly visible from the push-button station.

(5) Unless otherwise specified, all electrical materials, workmanship, and tests shall be in conformity with the current standard rules, regulations, and specifications of the American Institute of Electrical Engineers and of the National Electrical Manufacturers' Association.

12-07. Hand hoist. - a. The gate hand hoist shall be two-speed unit designed and built for hand operation of sluice gates, and shall be of sufficient capacity to raise or lower the gate against the maximum operating head with not more than a 40-pound pull on the crank. The hoist shall be made of cast iron conforming to Federal Specification

QQ-I-652. A standard indicator shall be provided with the gate hoist.

b. The pedestal and gear cases shall be made of cast iron conforming to Federal Specification QQ-I-652. The operating nut shall be of cast bronze and all gears shall be of steel of sufficient strength and properly designed for the service required. The hoist shall be equipped with two single row ball thrust bearings; one above and one below the operating nut. The gear shafts shall be provided with bronze bushings.

12-08. Furnishings and fittings. - a. The gate frames, guides, and hoists shall be designed and constructed to provide a satisfactory method of fastening them securely to concrete or other supports during erection as shown on the drawings. All bolts, special tools, and other devices necessary to erect the gates, frames, guides, and hoists as shown on the drawings shall be furnished by the contractor.

b. All bolts, nuts, screws, studs, pins, etc., shall be securely locked by satisfactory devices that will prevent loosening due to vibration.

12-09. Design. - a. The detailed design for the sluice gates, hoists, and accessories shall be such that all working parts shall be readily accessible for inspection and repair, easily duplicated, and readily replaced. Each part of the equipment shall be properly designed and suitable for the use and service required.

b. The design stress for any member or part of the material covered by these specifications shall not be greater than one-sixth of the ultimate strength of the material used.

12-10. Drawings. - The contractor shall submit for approval detail drawings for the sluice gates, hoists, and accessories he proposes to install in sufficient detail to check the design. These drawings shall be in accordance with Paragraph 1-04 and shall include a complete and itemized list of all parts, with the grade and class of material or make of a standard article, the contractor proposes to furnish. The item number in the list of parts shall be shown on the drawings by means of a circle enclosing the item number and a solid light line connecting the circle to the part. Proposed construction shall be clearly shown on the drawings by the liberal use of sections, enlarged details or by other means. Any item or part needed to provide a complete and workable installation in accordance with the intent of these specifications, shall be supplied by the contractor whether or not the same is included on the drawings, the list of parts, or in the requirements of these specifications. Approved drawings submitted by the contractor shall become a part of these specifications.

12-11. Materials and workmanship. - Each gate, with its hoist and accessories, shall be constructed of the grade and class of materials as shown on the "List of Parts" on the design drawings as furnished

by the contractor and approved by the contracting officer, and shall conform to the provisions of Section XI, where applicable. All metal workmanship shall be of approved standard quality.

12-12. Installation. - Each gate shall be completely assembled during installation and the leaf shall be screwed lightly into its seat and shall be held in place by jack screws. Care shall be exercised when drawing the frame up to the concrete to insure its being pulled against a true surface. All bolts shall be tightened carefully so as not to strain or warp the parts and to preserve proper alignment. Grout shall be poured between the face of the flange and the concrete to prevent any tendency to spring the frame. After installation, the jack screws shall be removed.

12-13. Inspection and tests. - a. The gates, hoists and accessories to be furnished shall be assembled in the shop as directed by the contracting officer for inspection and to insure that all parts fit accurately and are in proper alignment. Each gate shall be opened and closed to insure proper operation.

b. After completion of the pumping station and the installation of all machinery, each gate shall be tested for satisfactory operation by being raised and lowered several times for its full length of travel. Any adjustments in the setting or installation required to secure satisfactory operation and tight closure of the gates shall be made by the contractor. The gate hoists shall be tested as directed and any adjustments or changes that may be required in the opinion of the contracting officer shall be done by the contractor.

c. The cost of all testing shall be borne by the contractor, except for the Government's representatives, and shall be included in the contract price for Item 23.

12-14. Painting. - a. Painting shall conform to the applicable provisions of Section XIX.

b. For gates and gate guides there shall be one coat of metal filler, one shop coat of red lead and one field coat of red lead paint, of a color approved by the contracting officer, and two finish coats of graphite paint. Painting shall be similar or equal to Detroit Graphite Company's Iron-Gard System for underwater steel structures.

c. For gate hoists there shall be applied one coat of metal filler, one shop coat of red lead, one field touch-up coat of red lead, and two coats of selected engine enamel.

d. The touch-up coat shall be applied as may appear necessary to the contracting officer and shall be done with the same shade as the shop coat.

12-15. Payment. - a. Payment for designing, furnishing, painting

and installing the work included in Paragraph 12-01 will be made at the contract price for Item 23, "Sluice Gates, Complete with Hoists".

b. Partial payments up to 50 percent of the contract price will be made when the sluice gates, complete, are delivered to the site of the work provided the quality of such equipment is satisfactory to the contracting officer, but in no case will the payment to the contractor exceed the cost of the equipment delivered to the site of the work. The equipment shall be stored and kept protected from deterioration in a manner satisfactory to the contracting officer. If any equipment so stored and partly paid for is not kept protected, no further partial payments will be made and the equipment will be protected by the contracting officer at the expense of the contractor.

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SECTION XIII. HEATING AND VENTILATING EQUIPMENT (Item 24).

13-01. Work included. - The contractor shall furnish, install, and place in operation the steam heating equipment and the engine-room and pump room ventilating equipment. The steam heating system shall be of the two-pipe, gravity type consisting essentially of a cast iron sectional boiler fired by an oil burner, a 500-gallon fuel oil storage tank, and two unit heaters located in the engine room, together with steam piping, valves, and all accessories and appurtenances hereinafter required or shown on the drawings. The ventilating equipment shall consist essentially of a fan located on the roof of the pumping station, and a blower with connecting duct work located on the engine room floor. All piping and connections shall conform to local laws and regulations.

13-02. Boiler and burner. - a. The boiler shall be a Burnham Boiler Corporation No. 0-2109-S or equal water tube boiler complete with relief valve, gauge glass, and pressure gauge. The boiler shall have a capacity of not less than 1075 square feet of steam radiation. The boiler shall be insulated with 1-1/2 inch magnesia blocks and one-inch of magnesia plaster.

b. The oil burner shall be a Timken-Model GF or equal fully automatic pressure atomizing burner with constant electric ignition when in operation. The burner shall have a capacity of 1,800 square feet of steam radiation with a nozzle capacity of 5 gallons per hour. A fire brick combustion chamber shall be included with the burner. The oil burner motor shall be equipped with a thermal overload protective device which may be used as a switch and shall be suitably located.

13-03. Unit heaters. Each unit heater shall be a No. 85 Speed Heater as manufactured by the Crane Company, or its equal. The heater shall have a capacity of 85,600 B.t.u. per hour at a steam pressure of 2 pounds per square inch, an entering air temperature of 60 degrees Fahrenheit, and fan speed of 1080 RPM. The fan motor shall be suitable for operation on 115-volt, single-phase, 60-cycle current and shall be of the two-speed type with controller and thermal overload starting switch. The heater shall be supported two feet from the wall on a substantial steel bracket. The heater shall be automatically controlled by a pressurostat located on the steam supply line.

13-04. Control equipment. - The following control equipment as manufactured by the Minneapolis-Honeywell Company, or equal, shall be provided as indicated on the drawings:

Thermostat - T11A Acratherm

2 Pressuretrols - P404-B

Pressuretrol - L404A

Protectorelay - R117A

The boiler shall be equipped with a #47-2 combined water feeder and low water cut-off as manufactured by the McDonnell-Miller Company, or equal. Provision shall also be made for manual boiler feed.

The air valves on the unit heaters shall be Hoffman No. 75 float type, or equal. Gate valves shall be Crane No. 438 or equal standard brass gate valves, and steam traps shall be Armstrong #215 (1-1/4") and #216 (2") or equal.

13-05. Fuel tank and piping. - a. The fuel oil tank shall be a 500-gallon, 1/4-inch, welded steel tank 3-1/2 feet in diameter and 8 feet long set on concrete supports underground and suitably anchored as indicated on the drawings. The fill line and vent line shall be of standard weight, galvanized, wrought iron pipe with galvanized malleable iron fittings. A vent cap shall be provided on the vent line and the fill pipe shall have a lock type fill connection. The oil line from the tank to the burner shall be standard I.P.S. brass pipe with standard cast brass screwed fittings, and shall be fitted with a valve and cast iron valve box, located outside of the building.

b. The steam piping shall be standard weight black wrought iron pipe with malleable iron fittings. The steam main shall be supported from the engine room wall on Crane No. 2816 or equal welded steel brackets and Crane No. 2738 or equal steel pipe hangers with 1/2-inch rods. Steam lines in other locations shall be hung on Crane No. 2738 or equal hangers with 1/2-inch rods and concrete inserts. The steam lines shall be supported at least every ten feet. All steam supply and return piping shall be covered with 85 percent magnesia one inch thick. Fittings shall be covered with one inch of 85 percent magnesia plaster. All pipe insulation shall be sized and painted with two coats of paint as selected by the contracting officer.

13-06. Engine-room ventilation. - The engine room shall be ventilated by an electric-powered fan located on the roof. The fan shall be a Davidson No. 19 N.T.D. or equal high duty, copper housed fan with self-acting louvres, driven by a 3-speed, 115-volt, single-phase, 60-cycle motor. The fan shall have a capacity of 2,555 cubic feet of standard air per minute. The motor shall have a controller and a thermal overload starting switch located on the engine room wall 4 feet above the floor.

13-07. Pump room ventilation. - The pump room shall be ventilated by a blower located on the engine room floor with an intake duct run down to a point approximately one foot below the engine room floor and a discharge duct run out through the outside wall, as shown on the drawings. The blower shall be a No. 1-1/2 Sirocco utility blower or equivalent, driven by a 110-volt single-phase, 60-cycle motor. The blower shall have a capacity of 1725 feet of standard air per minute. The motor shall have a controller and a thermal overload starting switch located on the engine room wall. The intake duct shall be a 9-inch round, 20-gauge galvanized iron duct supported from the engine floor. The dis-

charge duct shall be a 9-inch round, 20-gauge galvanized iron duct connected to a 15-inch square louvre, set in the outside wall. The bottom of the louvre shall be set at Elevation 63.19.

13-08. Operation and tests. - After the heating and ventilating equipment has been installed, the contractor shall place it in operation and shall operate it for such length of time and in such a manner as to satisfy the contracting officer that it meets all the requirements of these specifications.

13-09. Payment. - Payment for furnishing, installing, and placing in operation the heating and ventilating equipment will be made at the contract price for Item 24, "Heating and Ventilating Equipment." Partial payment up to 50 percent of the contract price will be made when the heating and ventilating equipment is delivered to the site of the work provided the quality of such equipment is satisfactory to the contracting officer, but in no case will the payment to the contractor exceed the cost of the equipment delivered to the site of the work. The equipment shall be stored and kept protected from deterioration in a manner satisfactory to the contracting officer. If any equipment so stored and partly paid for is not kept protected, no further partial payments will be made and the equipment will be protected by the contracting officer at the expense of the contractor.

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SECTION XIV. LIGHTING AND POWER SYSTEM (Item 25)

14-01. Work included. - The contractor shall furnish and install complete and ready for operation, all equipment and wiring for the lighting and power system of the pumping station as indicated on the drawings and as required by these specifications. The contractor shall make all necessary connections to the gasoline-electric generating unit and the switchboard, all pump motors, sluice-gate motors, and motors for heating and ventilating, and shall furnish and install all wiring, conduits, outlets, fixtures, lamps, floodlight projectors, switchboard, lighting panelboard, control equipment, fittings, and junction boxes.

14-02. General description. - a. The complete power system includes conduits, wires, switchboard, control equipment, and all wire connections of external circuits to the several parts of the operating equipment.

b. The lighting system includes fixtures, lighting panelboard, floodlight projectors, switches, receptacles, conduits, wires for lighting, and the transformer and its connection to the switchboard.

c. The battery-charging system includes conduit and wire for battery-charging, battery charger with controls and meter for charging the battery on each gasoline engine through the wire and conduit brought up to each engine panel, and connections to battery-charging equipment at the switchboard.

d. The pumping station will be normally operated using power from the outside source, and the capacity of the standby generator will be sufficient to handle the total electrical load.

e. The electrical equipment throughout shall be so designed that it will not be affected by wide changes in temperature and moisture produced as a result of condensation.

14-03. Standard rules and specifications. - a. Unless otherwise specified, all electrical materials, workmanship, and tests shall conform with the current standard rules, regulations, and specifications of the following authorities:

(1) American Institute of Electrical Engineers, 33 West 39th Street, New York, N. Y.

(2) National Board of Fire Underwriters, National Electrical Code, 85 John Street, New York, N. Y.

(3) National Electrical Manufacturers Association, 155 East 44th Street, New York, N. Y.

(4) Bureau of Standards, National Electrical Safety Code, Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

(5) Insulated Power Cable Engineers Association, 420 Lexington Avenue, New York, N. Y.

(6) Federal specifications cited herein (Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.).

b. Copies of these rules, regulations, and specifications may be procured at the addresses as given, or may be seen at the U. S. Engineer Office, Providence, R. I.

14-04. Conduits. - a. Conduits shall be located as indicated on the drawings or as directed by the contracting officer.

b. The conduits shall be hot-dip galvanized or sherardized on both inside and outside, and shall meet the requirements of Federal Specification WW-C-581a for "Conduit, Steel, Rigid, Zinc-coated." Conduit fittings or bodies shall be galvanized, sherardized, or cadmium-plated high-test gray iron castings of the types and sizes specified or shown on the drawings, or required for the work to be done. They shall be approved by the National Board of Fire Underwriters, and be similar and equal to those manufactured by the Crouse-Hinds Company. Conduit sizes shall meet the requirements of Article 346 of the 1937 edition of the National Electrical Code with the exception that no conduits smaller than 3/4 inch shall be used.

c. The installation of conduits shall comply with Article 346 of the 1937 edition of the National Electrical Code. All wires and cables shall be run in rigid conduits forming a complete raceway from the cabinet or panel to the last outlet in the system. Conduits shall be run concealed in the floors and ceilings or run exposed on the walls as indicated on the drawings. Conduits in masonry walls and floors shall be built-in complete with all necessary fittings at the time the masonry is being placed. Any exposed conduits shall be securely fastened and anchored to the structural portions of the building and shall be run parallel with or at right angles to the walls. All conduits shall be run with long-radius bends where possible, and not more than the equivalent of three 90 degree bends shall be used on any run. All bends shall have a minimum radius of six diameters. If more than three bends are required, pull boxes shall be installed at points approved by the contracting officer. All conduit ends shall be reamed to remove burrs and obstructions after the threads have been cut. All conduit joints shall be made watertight with an approved sealing compound. At all conduit terminals there shall be provided approved bushings or conduit fittings. All metal conduit runs shall have electrical continuity.

Open conduit ends shall be capped in an approved manner, to exclude dirt and moisture. No threadless fittings or running-thread couplings shall be used on runs of conduit. As soon as possible after the concrete has set, each conduit shall be cleaned, inspected, and tested by the contractor to ascertain its mechanical and electrical continuity, and freedom from obstructions. Any defects in material or workmanship shall be remedied immediately as directed by the contracting officer. After each duct line is completed, the contractor shall inspect and test conduit in an approved manner and the conduit ends shall be capped.

14-05. Wiring. - a. The contractor shall furnish and install all wire and cable, terminals, junction boxes, supports, hangers, make all connections, grounds, and properly place, arrange, and identify all material as specified or directed by the contracting officer. All wiring shall be in rigid conduit unless otherwise specified, shown on the drawings, or directed by the contracting officer.

b. All wire used shall be copper, soft drawn and annealed, and having not less than 95 percent conductivity. Wire sizes shall comply with Article 300 of the National Electrical Code. No wire shall be used that is smaller than No. 12 A.W.G. except fixture wiring which shall not be smaller than No. 18 A.W.G. Insulation for all wires and cables shall be flame-retarding and moisture proof and shall conform to Federal Specification J-C-106 for "Cable and Wire: Rubber Insulated Building Type, Superaging Grade (0 to 5,000-Volt Service)."

c. All wire and cable shall be shipped on reels or in coils, plainly marked for complete identification, including the wire or cable size, number of conductors, length, weight, thickness, character of the insulation and the name of the manufacturer.

d. Materials used in the wiring shall conform to the following requirements:

(1) Solder for splicing or wiping shall conform to Federal Specification QQ-S-571, for "Solder Tin Lead," Grade "A" for sweat conductor joints.

(2) Solder for brazing shall conform to Federal Specification QQ-S-551, for "Solder, Brazing," Composition "B".

(3) Silver solder shall conform to Federal Specification QQ-S-561b for "Solder, Silver," Grade "0".

(4) Rubber tape shall conform to Federal Specification HH-T-111 for "Tape, Rubber Insulating."

(5) Friction tape shall conform to Federal Specification HH-T-101 for "Tape, Friction," Grade "A".

(6) Cotton tape shall conform to United States Navy Department Specifications 17-T-15 for "Tape, Insulating, Linen Finish, Plain," thickness .007 inch.

e. The motor feeders from the switchboard to the outside sluice-gate motors will be three-conductor No. 10 A.W.G., lead-covered cable, rated at 600 volts, 60 cycles, A.C. and shall conform to Federal Specification J-C-106 "Cable and Wire; Rubber-Insulated, Building-Type, Superaging-Grade (0 to 5000-Volt Service)."

14-06. Grounding. - Permanent and effective ground connections shall be provided for all metal cabinets enclosing electrical equipment for equipment frames and housings, continuous runs of metal conduit, and elsewhere to comply with Article 250 of the National Electrical Code, and as specified or directed by the contracting officer. The contact area of all joints in grounding circuits shall provide a current carrying capacity not less than that of the connecting wire or cable, and the joints shall be bolted, soldered, or brazed, as specified or as directed. All ground connections to equipment that may require removal for maintenance or repair shall be bolted to the equipment.

14-07. Lighting and outlets. - a. The lighting panelboard, fixtures, plug receptacles, tumbler switches, and outlet boxes shall be installed as specified and at locations indicated in the drawings and shall be in accord with the description as shown on the Bill of Material.

b. Lamps, except for floodlights, shall be rated at 115 volts and of the watt rating shown or specified and shall conform to Federal Specification W-L-101c for "Lamps, Electric, Incandescent, Large, Tungsten-Filament."

c. All lighting fixtures shall be installed as specified and at locations indicated on the drawings and shall be similar or equal to that specified in the Bill of Material. All fixtures shall be installed at locations as shown and conduit shall be run in the structural portion of the concrete slab as shown on the drawings.

d. Two floodlights shall be located on the roof parapet as shown on the drawings and shall be made adjustable so that the dike will be well-lighted. They shall be similar and equal to Crouse-Hinds ADE-16 Catalog No. 42932 each equipped with a narrow-beam, polished, Alzak reflector and a spread lens capable of giving the light beam a spread of 34-1/2 degrees horizontally and 14-1/2 degrees vertically. The lamp for each floodlight shall be type PS-52 rated at 1000 watts, 230 volts, 60 cycles, A.C.

e. One floodlight shall be located on the rear wall of the superstructure as shown on the drawing and shall be locked into position after the beam has been oriented properly so that the area including the trash rack and the gate hoist stand is well lighted. The floodlight shall be similar and equal to Crouse-Hinds Type ADE-14 Catalog No. 42740 equipped with a wide-beam, polished, Alzak reflector and a 50-degree spread lens. The lamp shall be Type PS-40 rated at 500 watts, 115 volts, 60 cycles, A.C. The mounting of the floodlight shall be a standard mounting. The lens shall be protected against breakage by a wire guard rigidly attached to the housing of the floodlight.

f. All sockets, switches, and receptacles shall be National Electric Code Standard and shall be in accord with the description as shown on the Bill of Material.

14-08. Miscellaneous electrical equipment. - a. The lighting panelboard shall be of the surface type, with 125/150 volt, 3-wire solid neutral mains, and 125-volt, 2-wire branches with single-pole, 125-volt, automatic circuit breakers in each circuit. The panelboards shall be similar or equal to Westinghouse Type NA1B and shall be in compliance with Federal Specification W-P-131.

b. A service switch shall be provided in the boiler room at the point where the service cable enters through the conduit in the foundation as shown on the drawings. The switch shall be 3-pole, single-throw, non-fusible, 400-ampere capacity rated at 600 volts, 60 cycles, A.C., mounted in a water-tight enclosure, designed for surface mounting, provided with an external operating handle, and shall be similar or equal to Crouse-Hinds Catalog No. YKMC 8434.

14-09. Switchboard. - a. The contractor shall furnish and install in the engine room at the location indicated on the plans, a three-panel, free-standing, safety, steel-enclosed, dead-front type switchboard with removable cover plates in the rear. This switchboard shall provide electric power control for the entire pumping station.

b. Facing the switchboard from the front, the panels left to right shall be arranged in a continuous row in the order named below. Each panel shall control the circuits listed.

(1) Panel No. 1.

Combined generator, exciter, and regulator panel for gasoline-electric standby generating unit. Capacity: 75 kw. at 80 percent power factor, 93.8 kva., 240 volts, 3-phase, 60 cycles, A.C. with 125-volt, D.C. direct-connected exciter.

Incoming feeders from the standby generating unit and the outside power source.

(2) Panel No. 2.

One feeder, 230 volts, 3-phase, 60 cycles, A.C. to the stator of the wound rotor induction motor for the 16-inch pump.

One feeder made up of control conductors from the drum controller to the secondary resistor of the 16-inch pump motor.

One feeder, 230 volts, 3-phase, 60 cycles, A.C. to the emergency cooling-water pump motor.

Battery-charging feeder 12 volts D.C. to the engine batteries.

(3) Panel No. 3.

One feeder, 230 volts, 3-phase, 60 cycles to the sump-pump motor.

Two feeders, 230 volts, 3-phase, 60 cycles, A.C. to the gate-hoist motors.

One feeder, 230 volts, single phase, 60 cycles, A.C. to the lighting transformer.

One feeder, 115 volts, single phase, 60 cycles, A.C. to the lighting panelboard.

One feeder, 230 volts, single phase, 60 cycles, A.C. to the battery charger.

One feeder, 230 volts, single phase, 60 cycles, A.C. to the two floodlights located on the roof parapet.

c. The panels shall contain the following equipment:

(1) Panel No. 1.

One voltage regulator and adjustment control.

One mounting for exciter-field rheostat (furnished under Section XV, Item 26).

One wattmeter 0 to 120 kw.

One voltmeter 0-300 volts, 60 cycles, A.C. with selector switch for reading the phase voltage of the incoming generator and the phase voltage of the incoming line from the outside power source complete with the necessary fuse cut-outs and fuses.

One field ammeter, 0-30 amperes, D.C.

Two 250-ampere three-pole air circuit breakers for the 93.8 kva. standby generator and the outside power source each provided with three instantaneous and three time-delay magnetic over-current trips and magnetic lockout attachments.

One ammeter, 0-300 amperes, 60 cycles, A.C. with the necessary current transformers and 3-phase selector switch for reading three-phase current.

(2) Panel No. 2.

One 225-ampere air circuit breaker, provided with two suitable thermal-overload and two instantaneous short-circuit trips for the wound rotor induction motor for the 16-inch pump.

One magnetic contactor with suitable thermal-overload trips for the wound-rotor motor.

One start-stop push button station for operating the contactor.

One drum controller for varying the external resistance in the rotor of the motor for the 16-inch pump.

One 15-ampere three-pole air circuit breaker provided with two suitable thermal-overload and two instantaneous magnetic short-circuit trips, and one time-delay undervoltage trip for starting the sump-pump motor directly across the line.

One 40-ampere two-pole air circuit breaker provided with two suitable thermal-overload and two instantaneous short-circuit trips for the output of the battery charger.

One battery charger complete with control equipment.

One ammeter, 0-40 amperes for indicating the output of the battery charger.

(3) Panel No. 3.

Two 35-ampere three-pole air circuit breakers provided with two suitable thermal-overload and two instantaneous short-circuit trips for the two gate-hoist motors.

One 100-ampere single-pole air circuit breaker provided with suitable thermal-overload and instantaneous short-circuit trips for the feeder to the lighting panelboard.

One 50-ampere two-pole air circuit breaker provided with two suitable thermal-overload and two instantaneous short-circuit trips for the primary of the lighting transformer.

One 15-ampere two-pole air circuit breaker provided with two suitable thermal-overload and two instantaneous short-circuit trips for the feeder to the floodlights located on the roof parapet.

One 15-ampere two-pole air circuit breaker provided with two suitable thermal-overload and two instantaneous short-circuit trips for the A. C. feeder to the battery charger.

One 10 kva. lighting transformer located inside the switchboard.

14-10. Construction of switchboard. - a. Panels. - The switchboard shall be of the dead-front type of construction conforming to the standards of the N.E.M.A. All panels shall be of 1/8-inch "Stretcher-leveled" steel with a 1/4-inch radius bevel on all front edges and of equal width. The width of the panels shall be such as to give a compact and neat arrangement of the equipment without sacrificing efficiency and accessibility in the operation and maintenance of the switchboard. The panels shall be bolted to the switchboard frame and each shall be subdivided into vertical sections which may be removed to give access to apparatus on the subpanel. Slots shall be provided to accommodate the handles of switches and breakers. There also shall be provided on the front of the panel a visual indicator of the mechanical type to show the position of each switch or breaker. No unsightly gaps or wide joints shall be visible in the completed assembly.

b. Rear cover plates. - The rear of the switchboard shall be enclosed by cover plates which shall run the full height of the switchboard and shall be arranged in convenient widths. One panel shall be in the form of a swinging door with lock and concealed hinges. The cover plates shall fit snugly and no gaps or wide joints shall be visible in the completed assembly.

c. Busses and wiring.- All power conductors shall be of the proper cross section for the currents to be carried and no wire shall be smaller than No. 8 A.W.G. All control wire on the panels shall be run in wiring gutters provided on the side of the panels and shall be brought out to terminal blocks when it leaves the panels. All busses shall be mechanically rigid and designed to carry the rated current of the circuit with a maximum temperature rise of 30 degrees C.

d. Finish. - All steel work shall be Bonderized or given similar treatment, and given a dull black marine finish.

e. Name plates. - Suitable name plates shall be furnished for all circuits, controls and instruments. Name plates shall be black bakelite with engraved letters.

f. A rubber insulating mat shall be furnished and placed in the front of the switchboard. It shall extend the full length of the switchboard, and shall be 36 inches in width.

14-11. Switchboard equipment. - a. Lighting transformer. - The contractor shall furnish and install inside the switchboard a 10 kva. transformer having a single-phase, 230-volt primary and a single-phase, two-wire, 115-volt secondary. The transformer shall be of the air-cooled dry type similar and equal to the General Electric Company type M.

b. Air circuit breakers for the feeders from the standby generator and the outside power source shall be three-pole, single-throw, stationary mounting, trip-free, manually-operated, rated at 600-volts, 60 cycles, A.C. and having an interrupting capacity of 20,000 amperes. The air circuit breakers for the generator feeder and for the feeder of the outside power source shall be provided with three instantaneous and three time-delay magnetic overcurrent trips and a magnetic lockout attachment on each circuit breaker. The magnetic lockout attachments on each shall be interconnected by means of auxiliary switches provided on the circuit breakers so that only one circuit breaker can be in the closed position at any time. These circuit breakers shall be similar or equal to type AE-1B as manufactured by the General Electric Company. The air circuit breakers for the emergency cooling water-pump motor shall be three-pole, single-throw, stationary mounting, trip-free, manually-operated, rated at 600 volts, 60 cycles, A.C. and having an interrupting capacity of 10,000 amperes. The circuit breaker shall be provided with two thermal-overload, two instantaneous magnetic overcurrent trips, and a time-delay undervoltage trip for starting the motors directly across the line. A mechanical locking device shall be provided for locking the circuit breaker in the open position. This circuit breaker shall be similar or equal to type AE-1A manufactured by the General Electric Company.

c. Air circuit breakers for feeder protection of motors and equipment feeding from the main bus shall be provided with two suitable thermal-overload and two instantaneous magnetic short-circuit trips and shall be rated at 600 volts, 60 cycles, A.C., having an interrupting capacity of 10,000 amperes. Circuit breakers for feeder protection of the feeder to the lighting panelboard and the feeder from the battery-charger output side shall be provided with suitable thermal-overload and instantaneous magnetic short-circuit trips and shall be rated at 230 volts, 60 cycles, A.C. These circuit breakers shall be similar or equal to type AB as manufactured by the Westinghouse Electric and Manufacturing Company.

d. The drum controller for varying the external resistance of the secondary winding of the wound-rotor induction motor driving the 16-inch pump shall be a non-reversing type, manually operated through a mechanism brought out to the front of the switchboard panel, provided with auxiliary contacts which are closed on "off" position only, and shall be similar or equal to the General Electric Company's type CR-3204. The starting handle shall provide for an "off" position and four operating positions.

A magnetic contactor operated by a "Start" "Stop", momentary contact, push button station shall control the primary circuit of the wound-rotor motor for the 16-inch pump, and shall be interlocked with the "off" position of the drum controller so that the motor cannot be started without having all of the secondary resistance in the rotor circuit at the time of starting. The magnetic contactor shall be similar or equal to the General Electric Company's type CR7006 complete with two manually-reset thermal relays.

The secondary resistors shall provide for speed-regulating and starting duty. The resistors shall consist of edgewise wound, non-breakable, non-corrodible type units clamped rigidly in place on insulated tie rods mounted in suitable end-frames, similar or equal to General Electric Company's type CR-3284. The resistors shall be mounted on the wall as indicated on the drawings and shall be arranged so as to provide a neat, compact assembly and to allow for efficient dissipation of the heat generated by the secondary currents. The resistors and controller shall provide control for the secondary of a standard 50-horsepower, 10-pole, wound-rotor induction motor to be furnished by the Government. The first stop of the controller, after the "off" position, will insert a sufficient amount of resistance into the secondary to limit the primary current, with the rotor blocked, to a value not greater than 100 percent of full load current when the motor torque is approximately full-load torque. On the second and third stops of the controller the value of the resistance shall be designed so that the motor will deliver 12 percent of rated horsepower at one-half full-load speed, and 40 percent of rated horsepower at three-quarters full-load speed, respectively. The fourth stop shall short-circuit the secondary resistance. The resistors for each stop shall be rated for continuous operating duty.

e. Instrument switches for reading line voltages and currents shall be the rotary type and similar and equal to the General Electric Company type SB-1.

f. The voltage regulator shall be designed for automatic voltage control of the generator and arranged for operation in the exciter shunt-field circuit. It shall provide good regulation up to 150 percent of rated generator capacity and shall be similar and equal to General Electric Company's type GDA. Voltage fluctuations in the generator output due to starting of motors shall not exceed a period of 6 cycles based on 60-cycle, A.C.

g. A battery charger of approved make, similar and equal to the product of the General Electric Company, shall be installed inside the switchboard. The output side shall be connected to the battery-charging system (described in Paragraph 14-02 c) and the input side shall be capable of operating at 230 volts, 60-cycle, A.C., and shall have sufficient capacity to charge five twelve-volt batteries in parallel at a charging rate of 6 amperes each. It shall be provided with an adjustment for varying the charging rate from zero to maximum in at least 30 steps and an ammeter to indicate the direct current output both of which shall be mounted on the front of the switchboard.

h. All fuses shall comply with Federal Specification W-F-791 for "Fuses, Cartridge, Inclosed, Non-Renewable."

i. Meters shall be rectangular, semi-flush mounted, have a five-inch scale and shall be similar and equal to the corresponding product of the General Electric Company.

14-12. Motor control for the sump-pump motor shall consist of an enclosed magnetic across-the-line starter similar and equal to the Westinghouse Electric and Manufacturing Company's Class 11-200, push-button operated and arranged to provide thermal overload and under-voltage protection to the motor.

14-13. Payment. - The contractor will be paid the contract price for Item 25, "Lighting and Power System," for furnishing, installing, testing, and placing in operation the lighting and power system as required by the specifications and shown on the drawings.

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SECTION XV. GASOLINE-ELECTRIC STANDBY UNIT (Item 26)

15-01. Work included. - The contractor shall furnish and install one complete and fully equipped gasoline-electric generating unit in the location shown on the drawings.

15-02. General description. - a. The unit shall consist of a gasoline engine direct-connected through a flexible coupling to a synchronous type generator with direct-connected exciter, all mounted on a common cast iron or structural steel base. The generating unit shall supply 3-phase, 60-cycle alternating current at 240 volts, and shall have an output rating of 93.8 kv.a. at 80 percent power factor.

b. The unit shall be equipped with a storage battery and electric starting motor, an exciter field rheostat, detachable hand crank, and all other necessary appurtenances for complete installation.

c. Vibration. - The unit, complete with all accessories, shall be free from objectionable vibrations within the range of 60 r.p.m. below to 60 r.p.m. above normal speed.

d. Fuel. - The engine fuel used in all tests shall conform to Federal Specification VV-G-101a for "Gasoline; Motor, United States Government," and shall have an octane number of 60 to 70.

15-03. Gasoline engine. - a. The gasoline engine for the standby unit shall be the product of a reliable manufacturer who can show at least five years' experience in the successful manufacture of engines for similar duty. The engine shall be of the four-cycle type with 4 or more cylinders and shall have a published continuous rating of not less than 150 brake horsepower at 1200 r.p.m. It shall also have a published continuous speed rating of not less than 1200 r.p.m. The maximum horsepower of the engine shall be not less than 15 percent greater than that required at full output of the generator at 1200 r.p.m.

b. Parts and accessories. - (1) The following is a list of the accessories and equipment that shall be furnished and installed with the engine. Any and all other devices necessary for the proper operation of the engine shall be furnished and installed.

(a) Gasoline carburetors with automatic chokes.

(b) Oil bath air filter and backfire arrester.

(c) Dual ignition system.

(d) Storage battery in case.

(e) Electric starter.

(f) Muffler and exhaust pipe.

(g) Water cooled exhaust manifold.

(h) Water temperature gauge.

(i) Water temperature safety switch and fittings.

(j) Oil pressure safety switch and fittings.

(k) Instrument panel for mounting of all instruments and switches.

(l) Governor.

(m) One set of all tools necessary for maintenance and adjustments of the engine mounted in a suitable box.

(n) Engine-driven fuel pump and a hand-operated fuel pump.

(2) All parts and accessories shall be made of the finest materials available for their specific use and shall be the product of reputable manufacturers.

(a) The crank case shall be of the pedestal base type with large side plates easily removable for inspection and adjustment of all bearings and other parts.

(b) The crank shaft shall be made of one piece, heat treated alloy steel forging substantially designed to withstand the most severe operating conditions. It shall be dynamically and statically balanced and all journals shall be ground and polished.

(c) The flywheel shall be steel constructed to withstand the maximum speed of the engine and shall be securely attached to the shaft on the engine side of the flexible coupling.

(d) The flexible coupling shall be of an approved type and shall be provided with a suitable guard. The coupling shall be suitable for transmitting 300 percent of the normal operating torque of the engine.

(e) The cylinders and cylinder heads may be cast as desired. Individual cylinder liners shall be used if cylinders are cast enbloc. The cylinder head shall be made of suitable material and shall be readily removable for repairs. All cylinders, valve seats and parts shall be completely water jacketed, and the water flow controlled by suitable openings in the head so that no steam pockets are formed. Cylinders shall be honed to suitable size.

(f) The pistons may be of light weight cast iron or suitable alloy. There shall be not less than 4 piston rings, of which

three shall be compression rings located above the piston pin bearing. The rings shall be of the finest grade piston ring material. The piston pins shall be of hollow steel, hardened, accurately ground and securely locked in place.

(g) The connecting rods shall be of high grade forged steel properly heat-treated and substantially designed to resist all thrust loads.

(h) The camshaft shall be of high grade forged steel, heat-treated, and so designed to perform satisfactorily its function on the engine.

(i) Push rod guides shall be made of suitable material to resist wear and heat and shall be removable.

(j) The main bearings shall be of a readily removable sleeve type and shall be accurately fitted and anchored against side thrust. Oil, under pressure, shall be suitably admitted to the inside of each main bearing shell.

(k) The valves shall be of special heat resisting steel, of large area, accurately fitted and ground to fit the valve seats. The valve seats shall be removable and of special steel, heat-treated.

(l) The engine shall be equipped with force-feed lubrication to the main bearings, connecting rod bearings, valve operating mechanism, piston pins and timing gears. An oil pressure gage shall be installed on the control board. The oil shall be supplied under pressure by a positive displacement, gear-driven pump. The pump shall be accessible and removable without dismantling the engine. A suitable, high grade oil filter with safety by-pass valves and oil cooler shall be provided and installed on the engine.

(m) The engine shall be equipped with an engine-driven fuel pump and a hand-operated fuel pump to furnish fuel from the fuel tanks located as shown on the drawings. The carburetor shall be of the heavy-duty type equipped with a drip pan and suitable connections for drainage back to the storage tank. The air intake of the carburetor shall be provided with a backfire flame arrester and the carburetor shall be equipped with an approved make of air cleaner.

(n) A dual ignition system shall be provided consisting of a 12-volt battery-distributor system and an approved magneto with an impulse coupler system. The ignition shall be so controlled that either system of ignition may be used by operating a switch. Each cylinder shall be equipped with two spark plugs.

(o) A temperature regulated valve shall be installed in the cooling water intake to regulate the flow of cooling water through the engine. The regulator shall be equal to that manufactured by the Fulton

Sylphon Company. There shall be provided a pressure temperature-operated switch so arranged that it will open the ignition circuit in the event the oil pressure is not adequate for safe operation of the engine or in the event the cooling water temperature exceeds that at which the switch is set to operate.

(p) Storage battery. - One 12-volt electric storage battery shall be provided. The battery shall be of sufficient capacity that when fully charged it will give four starting attempts of 30 seconds each with one minute rest period between, and at an ambient room temperature of 35 degrees Fahrenheit. The battery shall be assembled in a 6-cell unit in rubber jars having high ribs to provide large sediment space, hard rubber cell covers with grease ring seal nuts to keep the tops of the cells clean and dry, and vent plugs constructed to prevent the escape of electrolyte spray. Separators shall extend above and below the plates and the plates shall effectively retain the active material. The electrolyte shall be of the low-gravity type with a specific gravity of about 1.210. The battery shall conform to the specifications for United States Government award by Treasury Department, Procurement Division, Branch of Supply for lead-acid storage batteries, Class 17, Item B-8630. The battery shall be installed on a neatly finished wooden platform with lead tray, located adjacent to the engine and of a form convenient for handling batteries.

(q) The engine shall be equipped with an efficient governor of the non-hunting type, similar and equal to Type WO as manufactured by Woodward Governor Company, which shall provide a speed regulation within 3 percent of a normal operating speed at 1200 r.p.m. from 3/4 load to full load. The speed variations at any one continuous load shall be not more than 1.5 percent from the normal operating speed of 1200 r.p.m. On test, the variation in speed, caused by instantaneous load changes from full load to no load and from 1/4 load to full load, shall be not more than 5 percent from the normal operating speed of 1200 r.p.m.

(r) The starting of the engine shall be by means of an electric starter in conjunction with the storage battery. The cranking speed for starting shall be not less than 200 r.p.m. at 30 degrees Fahrenheit and the starting system including the battery shall be of sufficient capacity to crank the unit as specified in sub-paragraph (p) above. The starting push button switch shall be so designed that current from any pump engine battery will not flow to aid the battery of the standby unit when the starting motor is operated.

(s) Engine exhausts. - The exhaust manifold shall be a close-grained gray iron casting, water-cooled with suitable flange connections having a straight pipe thread for exhaust pipe. The exhaust pipe shall be standard weight wrought iron pipe, and shall be run through the roof as shown on the drawings. The exhaust silencer shall be of the dry type and shall be capable of reducing the engine noises to an absolute minimum. The exhaust pipe shall be insulated with two-inch asbestos pipe covering.

(t) An instrument panel shall be mounted on the engine, and shall contain an oil pressure gage, water temperature gage, tachometer, ignition switch, panel light and starting button. Spark and throttle control quadrants shall be suitably mounted on the engine. The engine shall be provided with a hand-starting lever and also one set of all necessary tools and wrenches to fit all volts, nuts, screws, and other items of the equipment furnished.

15-04. Generator. - a. The generator shall be of the standard, rotating field, synchronous type having the rating specified in Paragraph 15-02. When the generator is operating continuously at full rated load and voltage, the temperature rise in the cores and windings shall not exceed 50 degrees Centigrade above an ambient of 40 degrees Centigrade. The generator shall conform to the standards of the American Institute of Electrical Engineers and the National Electrical Manufacturers Association. It shall be a regularly manufactured type and model of a make that has been regularly manufactured for at least 5 years.

b. The stator and rotor windings shall be insulated with Class "A" insulation and shall be specially designed to resist moisture during long periods of idleness. The armature terminals shall be located as shown on the drawings, and shall be housed in a terminal box, with a removable cover, to which conduit may be readily connected from below.

c. The generator shall be provided with two sleeve bearings of ample size. The bearings shall be of phosphor bronze or bronze and babbitt-lined, and shall be positively self-lubricated by oil rings extending into an oil reservoir.

d. Slip rings shall be of bronze or brass. Brush holders shall be of rugged construction and shall be provided with an adjustable tension spring which can be adjusted while the machine is in operation and then locked in position. All ferrous materials shall be corrosion-resisting or shall be rust-proofed by a suitable process.

15-05. Exciter. - The exciter shall be mounted on an extension of the generator-end bracket, and shall be direct-connected to the generator. The exciter shall be shunt wound and of sufficient capacity to afford proper excitation to the generator field coils at 150 percent of the generator rating. The terminal voltage shall be 125 volts d-c. A rheostat shall be furnished for the exciter field and shall be of the rotary type suitable for mounting on the back of the power switchboard with the controls extending through to the front of the switchboard.

15-06. Design and drawings. - a. The detailed design of the standby unit shall be such that all working parts shall be readily accessible for inspection and repair, easily duplicated, and readily replaced with each and every part of the equipment of the machine properly designed and suitable for the uses and service required.

b. Before purchasing the gasoline-electric standby unit, the contractor shall furnish drawings and specifications for the proposed

standby unit for approval. The drawings shall include the engine, generator, exciter, and all accessories, with dimensions of concrete base for mounting. Accessories shall be listed on the drawings by catalog number with name of manufacturer; and shall be accompanied by cuts and the manufacturer's specification for the accessories, all properly numbered to agree with the list as shown on the drawings.

15-07. Installation. - All work shall be neatly and accurately done and shall be in accordance with the highest standards of practice for equipment of the type to be furnished. The engine and generator shall be accurately aligned on the bed-plate and securely attached thereto. Provision shall be made for lifting the engine and generator, each separately, and the entire unit completely by a crane. The unit shall be erected accurately to line and level, including the concrete base required therefor; thoroughly secured; and every detail of the work of installation shall be done in a thoroughly workmanlike manner.

15-08. Inspection and tests. - a. Shop tests. - The engine alone shall be run two hours continuously at a load corresponding to 50 percent overload of the generator on dynamometer test. The combined unit shall be tested by operation at the works of the manufacturer for not less than 8 hours in the presence of an authorized representative of the contracting officer. Under this test, and for any test load specified, there shall be no evidence of serious vibration. The valve setting and governor adjustment shall be checked with the combined unit operating under various loads in the speed range specified. Immediately after the tests the contracting officer may require the engine to be opened up for inspection. A typewritten record of all shop tests, including all observations, results, and graphs, shall be certified and submitted to the contracting officer, in triplicate, as soon as practicable after completion of the tests.

b. Final acceptance tests. - Final acceptance tests and trials of the gasoline-electric generator set shall be made by the contractor upon completion of the installation. The tests shall cover a period of twelve (12) continuous hours, during which period the combined engine-generator unit shall provide the normal rated output. If during the tests any imperfection of equipment, workmanship, or arrangement is found, proper correction shall be made and the entire test or any portion of it, as directed by the contracting officer, shall be repeated. In order to secure approval in these tests, the gasoline engine shall operate smoothly, without undue noise or vibration; the governor shall maintain an even speed at all loads and the carburetors shall function without flooding and without back-firing; the electrical equipment shall operate without any indication of excessive heating and shall maintain an even voltage at all loads. Such additional tests as may be necessary may be required by the contracting officer. A representative of the manufacturer of the unit shall supervise the running of final acceptance tests. All final acceptance tests shall be made in the presence of an authorized representative of the contracting officer.

15-09. Painting. - Shop painting shall be in accordance with the provisions of Paragraphs 19-02, 19-04 and 19-08. Such retouching as may

appear necessary in the opinion of the contracting officer, shall be done with the same shade of paint as the shop coat. All finished surfaces to be exposed to the atmosphere during shipment shall be coated with a heavy rust preventive compound. Field painting of all exterior parts, except brass, bronze or finished surface shall be done in accordance with the provisions of Paragraph 12-14 c.

15-10. Payment. - a. Payment for furnishing and installing the gasoline-electric standby unit will be made at the contract price for Item 26, "Gasoline-Electric Standby Unit," and shall include all costs of furnishing the concrete base therefor.

b. Partial payment up to 50 percent of the contract price will be made when the equipment is delivered to the site of the work, provided the quality of such equipment is satisfactory to the contracting officer, but in no case will the payment to the contractor exceed the cost of the equipment delivered to the site of the work. The equipment shall be stored and kept protected from deterioration in a manner satisfactory to the contracting officer. If any equipment so stored and partly paid for is not kept protected, no further partial payments will be made and the equipment will be protected by the contracting officer at the expense of the contractor.

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SECTION XVI. TRAVELING CRANE, COMPLETE (Item 27).

16-01. Work included. - The contractor shall design, furnish and install one traveling crane, complete. The crane shall be mounted on the track in the pumping station ready for operation, in accordance with the drawings and the specifications.

16-02. General description. - The crane shall be hand-operated, and shall have a working capacity of not less than 7-1/2 tons carried on one trolley. The distance from center line to center line of crane rails shall be 23 feet 6-1/4 inches. The distance from operating floor to top of crane rail shall be 15 feet 0 inches. Clearance limitations are shown on the drawings.

16-03. Detailed description. - The crane shall consist essentially of a double I-beam or double box-girder bridge mounted on two trucks, each truck having two double-flanged wheels and geared for hand-chain-operated travel, and a chain-operated traveling trolley provided with an integral, chain-operated, self-locking hoist. The crane shall be similar and equal to the "Shaw-Box", type "BR", as manufactured by Manning, Maxwell and Moore, Inc. The hoisting rope shall conform to the requirements of Federal Specification RR-R-571 for Rope, Wire, Type XXXIII, and shall provide for a vertical lift of not less than 37 feet. The operating chains shall provide for hand operation from the engine room floor 15 feet below the top of the crane rail. The hoist drum shall be grooved to receive the wire rope. Provisions shall be made for proper lubrication of all moving parts. After installation the crane shall be tested for 25 percent overload.

16-04. Design. - a. The detailed design of the traveling crane shall be in accordance with the clearances indicated on the drawings and with these specifications. All working parts shall be readily accessible for inspection and repair, properly designed and suitable for the use and service required.

b. The design stress for any member or part of the material covered by these specifications shall not be greater than one-fifth of the ultimate strength of the material used.

16-05. Drawings. - In accordance with Paragraph 1-04 c, the contractor shall submit for approval detail drawings for the traveling crane he proposes to install, in sufficient detail to enable a check on the design. These drawings shall include a complete and itemized list of all parts, with the grade and class of material or make of a standard article, the contractor proposes to furnish. The item number in the list of parts shall be shown on the drawings by means of a circle enclosing the item number and a solid light line connecting the circle to the part. Thickness of plates and sizes of structural shapes must be shown either on the part or in the itemized list of parts. Proposed construction shall be clearly shown on the drawings by the liberal use of sections, enlarged details and by other means. Any item or part needed to provide a complete and workable installation in accordance with the intent of these specifications, shall be supplied by the contractor, whether or not it is included on the drawings, the list of parts, or in the requirements of these specifications. Approved drawings submitted by the contractor shall become a part of these specifications.

16-06. Materials and workmanship. - The traveling crane shall be constructed of the grade and class of materials as shown on the "List of Parts" on the design drawings as furnished by the contractor and approved by the contracting officer and shall conform to the provisions of Section XI, where applicable. All metal workmanship shall be of approved standard quality.

16-07. Installation. - The traveling crane shall be assembled and installed in the pumping station, as shown on the drawings.

16-08. Inspection and tests. - The traveling crane will be tested by the Government as soon as practicable after installation. The field tests will include complete operation of the crane throughout all of its functions. Acceptance and final payment will not be made until such tests are completed to the satisfaction of the contracting officer.

16-09. Painting. - Shop painting shall be in accordance with the provisions in Paragraphs 19-02, 19-04 and 19-08. Such retouching as may appear necessary in the opinion of the contracting officer, shall be done with the same shade of paint as the shop coat. All finished surfaces to be exposed to the atmosphere during shipment shall be coated with a heavy rust preventive compound. Field painting of all exterior parts, except brass, bronze or finished surfaces shall be done in accordance with the provisions in Paragraph 12-14 c applying to gate hoists.

16-10. Payment. - a. Payment for designing, furnishing, and installing the traveling crane will be made at the contract price for Item 27, "Traveling Crane, Complete," and includes all necessary accessories not included in any other item.

b. Partial payment up to 50 percent of the contract price will be made when the traveling crane is delivered to the site of the work provided the quality of the equipment is satisfactory to the contracting officer, but in no case will the payment to the contractor exceed the cost of the equipment delivered to the site of the work. The traveling crane shall be stored and kept protected from deterioration in a manner satisfactory to the contracting officer. If any equipment so stored and partly paid for is not kept protected, no further partial payments will be made and the equipment will be protected by the contracting officer at the expense of the contractor.

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SECTION XVII. MISCELLANEOUS EQUIPMENT (Item 28 to 34 incl.)

17-01. Sump pump (Item 28). - a. Description. - The contractor shall furnish and install one vertical centrifugal sump pump of the submerged type with discharge piping, as indicated on the drawings. The pump shall have a capacity of 50 gallons per minute against a total head of 35 feet. The pump shall have a cast iron casing and a bronze impeller of either the closed or open type capable of passing coarse or fibrous material. The shaft shall be of stainless steel enclosed in a wrought iron support pipe. The upper bearing shall be of the combined radial and thrust type, grease lubricated anti-friction bearing. The lower and intermediate bearing shall be made up of a non-seizing, non-scoring high lead bronze bearing bushing with a grease reservoir. The reservoir shall be connected through suitable piping to an Alemite or Zerk fitting above the pit cover. The pump shall be bolted or welded to a small cover plate which in turn shall be bolted to the pit cover. The pump shall be driven by a 220-volt, 3-phase, 60-cycle, 1750 r.p.m., vertical, squirrel-cage, drip-proof induction motor with low starting current and normal starting torque characteristics. The motor shall be rated not less than one horsepower with a limiting temperature rise of 40 degrees Centigrade, and shall have a special moisture resisting treatment for all insulation in accordance with the N.E.M.A. standards.

b. Payment. - The contractor will be paid the contract price for Item 28, "Sump Pump", for furnishing and installing the sump pump.

17-02. Water supply and plumbing fixtures (Item 29). - a. Work included. - The contractor shall furnish and install a complete water supply and circulating system for furnishing cooling water to the gasoline engines, and other necessary fittings and plumbing fixtures. The City of Chicopee will bring the water service to a point outside the pumping station as shown on the drawings and will install a water meter. The contractor shall connect on the City's water service and furnish and install all pipe, valves, cocks, fittings, and plumbing fixtures as shown on the drawings and required by these specifications.

b. Piping and valves. - (1) All piping for the engine cooling system shall be standard weight galvanized wrought iron pipe meeting the requirements of Federal Specification WW-P-441 for Wrought Iron Pipe. Fittings shall be standard galvanized malleable iron pipe fittings. All piping and connections shall conform to local laws and regulations. Ground joint unions shall be inserted in every 30-foot run of pipe, at each piece of equipment and at such other points as required to facilitate the assembly and dismantling of the piping. The piping shall be supported at least every 10 feet on Clevis or equal hangers with 1/2-inch rods and concrete inserts. All valves shall be standard brass gate valves similar and equal to Crane No. 438 or Walworth No. 4. Funnels on the cooling water waste from the engines shall be 9 inches in diameter and 9 inches high, made of 16-ounce copper, and shall have a

beaded top. The water supply connection to each engine shall be made with a short section of flexible metal hose similar and equal to that manufactured by the Chicago Metal Hose Corporation or the Packless Metal Products Corporation.

(2) Water supply pipe for plumbing fixtures shall be standard I.P.S. brass pipe conforming to Federal Specification WW-P-351 for Brass Pipe. Pipe fittings shall conform to Federal Specification WW-P-448 for 125-pound Brass or Bronze Pipe-Fittings. Valves shall be standard brass gate valves similar and equal to Crane No. 438. Hose cocks shall be 3/4-inch finished brass tee-handle faucets similar and equal to Crane No. C31103. Piping shall be supported at least every ten feet with Clevis or equal hangers with 1/2-inch rods and concrete inserts.

c. Plumbing fixtures. - The plumbing fixtures shall conform to the requirements of Federal Specification WW-P-541 for Plumbing Fixtures. The lavatory shall meet the requirements for Outfit No. IB21, cast iron enameled, 21-inch, wall-hung. It shall be furnished complete with one compression faucet, 1-1/2-inch P trap, chainstay, chain, and stopper. The water closet shall meet the requirements for Outfit No. E46F vitreous china water closet, siphon jet elongated bowl, with flushing valve. All exposed supply and drain piping at the fixtures shall be chromium plated brass tubing and all handles and escutcheons shall be metal. The partition enclosing the plumbing fixtures shall be the movable steel Masterwall Type AA with flush panel door as made by the E. E. Hauserman Company of Cleveland, Ohio, or equal, unless otherwise shown on the drawings. The contractor shall furnish detail drawings of the partition for approval in accordance with the provisions of Paragraph 1-04 c.

d. Payment. - The contractor will be paid the contract price for Item 29, "Water Supply and Plumbing Fixtures" for furnishing and installing the water supply piping and plumbing fixtures in accordance with the specifications and drawings.

17-03. Carbon dioxide fire extinguishing equipment (Item 30). - a. Work included. - The contractor shall furnish and install a complete manually-operated, carbon dioxide fire extinguishing system for the protection of the three gasoline engines driving the pumps, and the gasoline-electric generating unit. The system shall be installed as indicated on the drawings and shall consist essentially of the following equipment:

4 - 50-pound capacity cylinders of carbon dioxide

1 - Steel angle frame assembly with wire mesh enclosure

5 - 1/2-inch manually-operated directional valves

1 - Manually-operated remote control station

1 - 3/4-inch pipe header

1 - set-1/2-inch branch piping to engines

1 - set-carbon dioxide discharge nozzles

1 - Spare parts kit and operating instructions

In addition to the above, there shall be furnished two portable, 15-pound, carbon-dioxide extinguishers, each with 3 feet of hose, a nozzle, and a permanent shut-off of the seat type. Each portable extinguisher shall be mounted on a wall bracket at the location shown on the drawings. The equipment shall be similar and equal to that manufactured by Walter Kidde and Company or the C-O-Two Equipment Company.

b. The system shall be so arranged that two carbon-dioxide cylinders are connected and ready for use at all times and the other two are connected for reserve use in the event the contents of the first two cylinders are exhausted. All pipe shall be standard black wrought iron pipe, and the arrangement of the piping and valves, and the number and location of the nozzles, shall be as recommended by the manufacturer.

c. Payment. - The contractor will be paid the contract price for Item 30, "Carbon Dioxide Fire Extinguishing Equipment", for furnishing and installing the carbon-dioxide fire extinguishing equipment as required by the specifications and the drawings.

17-04. Emergency water supply system (Item 31). - a. The contractor shall furnish a single stage, single or double suction pump with necessary suction line, strainers and fittings, as indicated on the drawings.

b. The pump shall be a single stage, single or double suction, bronze-fitted centrifugal type, and shall be provided with a split case that will permit the removal of the top section without disturbing the suction or discharge connections. The casing shall be of close grained cast iron. The pump shall have a bronze impeller of the enclosed type, hydraulically balanced and firmly secured to the shaft. The shaft shall be of stainless steel accurately ground to size and polished to a smooth surface. The shaft shall be supported by two double row grease lubricated ball bearings located one on each side of the pump. Suitable stuffing boxes shall be provided to prevent air leakage. The pump shall have a capacity of 100 G.P.M. against a total head of 50 feet. The pump shall be direct-connected through a flexible coupling to a 220-volt, 3-phase, 60-cycle, 1750 r.p.m., drip-proof squirrel cage induction motor, which shall have a limiting temperature rise of 40 degrees Centigrade, and all insulation specially treated to resist moisture. The motor shall have low starting current and normal starting torque characteristics. The horsepower rating of the motor shall be not less than the power required by the pump at specified capacity and head and shall be manufactured and rated in accordance with the N.E.M.A. standards. The pump and motor shall be mounted on a common cast iron base.

c. The suction line shall be standard wrought iron pipe and shall be installed as indicated on the drawings.

d. Payment. - The contractor will be paid the contract price for Item 31, "Emergency Water Supply System", for furnishing and installing the emergency water supply system as required by the specifications and the drawings.

17-05. Drains (Item 32). - a. Work included. - The contractor shall furnish and install all waste, drain and vent piping, and roof drains. The work shall include the waste lines from the plumbing fixtures, the exhaust pipe draw-off, roof drains, and other drain and waste piping shown on the drawings, but shall not include the waste cooling water lines from the engines which form a part of the engine cooling water system and are included under Item 29.

b. Piping. - Drain, waste, and vent piping shall, in general, be standard weight galvanized wrought iron pipe conforming to Federal Specification WW-P-441 for Wrought Iron Pipe. Fittings shall be standard screwed galvanized cast iron drainage fittings. Where soil pipe is called for it shall be cast iron, bell-and-spigot soil pipe conforming to Federal Specification WW-P-401 for Cast Iron Soil Pipe and Fittings. Cast iron pipe shall be laid with the bell end pointing in the opposite direction to the flow of the waste water. The joints shall be made tight with pure oakum caulked into the bell of the pipe until one-third full, and the remaining two-thirds of the bell shall be poured full of molten pig lead and caulked flush with the hub. Vent lines extending through the roof shall be flashed with 16-ounce copper brought up and turned down into the pipe. Vents shall extend at least 18 inches above the roof. Roof drains shall be galvanized cast iron roof drains with dome and strainer, and shall be similar and equal to No. 453-C as manufactured by the Josam Manufacturing Company of Cleveland, Ohio.

c. Payment. - The contractor will be paid the contract price for Item 32, "Drains", for furnishing and installing drains, vents, and waste lines as required by the specifications and shown on the drawings.

17-06. Gasoline tank and piping (Item 33). - a. The contractor shall furnish and install one gasoline storage tank together with interconnecting piping, fill and vent pipes, gasoline gage, and supply and drain piping to the gasoline engines and gasoline-electric standby unit as shown on the drawings.

b. The gasoline tank shall be of welded steel construction, and shall comply with the legal requirements of the City of Chicopee, Massachusetts.

c. All piping outside the pumping station shall be wrought iron pipe conforming to Federal Specification WW-P-441. Fittings shall be malleable iron screwed fittings conforming to Federal Specification WW-P-521. All piping inside the pumping station shall be copper tubing conforming to Federal Specification WW-T-799, installed with flared fittings. Valves in the gasoline lines shall be malleable iron wedge gate valves similar and equal to Crane No. 1492 Standard All-Iron valve. One standard

cast iron valve box shall be installed as shown on the drawings. The foot valves on the suction lines inside the gasoline tank shall be of the Single Poppet type similar and equal to Amco Figure 438. The vent pipes shall be securely clamped to the concrete wall. The wrought iron pipe sleeves covering the gasoline lines in the boiler room shall be insulated with a 1-inch asbestos covering.

d. The gasoline gage shall be installed on the wall of the engine room as shown on the drawings. It shall be capable of indicating the amount of gasoline in the storage tanks and shall be of the automatic remote reading type similar and equal to that manufactured by the Liquidometer Corporation of Long Island City, New York. It shall be float operated, the motion of the float operating against sylphons of a closed hydraulic system, and the system shall be filled with a liquid for the purpose of transmitting the motion of the float to the indicator sylphons. The indicator shall be installed in a protecting case not less than 12 inches by 12 inches and provided with a scale graduated to 3,200 gallons. The flexible tubing shall be protected by a metallic armor for connecting the indicator with the float mechanism. The connection between the gasoline tank and the gage line shall be protected by a structural steel box of suitable size.

e. Payment. - The contractor will be paid the contract price for Item 33, "Gasoline Tank and Piping" for furnishing and installing the gasoline tank, gage and piping in accordance with the drawings and specifications.

17-07. Float gage (Item 34). - a. Description. - The contractor shall furnish and install an indicating dial type float gage. The float gage well shall be of 6-inch, standard weight, genuine wrought iron pipe installed at the location and in the manner shown on the drawings. The float, tape, and counterweight shall be made of corrosion-resisting metal. The dial shall be 12 inches in diameter and graduated from 0 to 20 feet in tenths of a foot. The equipment shall be similar and equal to the No. 639 Dial Indicator manufactured by the W. and L. E. Gurley Company of Troy, New York. The protection grille for the tape shall be baked enamel wire-mesh of 1/8-inch wire, with 1-1/2-inch diamond shaped mesh complete with ferrule for attaching the grille to the pumping station wall.

b. Payment. - The contractor will be paid the contract price for Item 34, "Float Gage", for furnishing and installing the float gage and well in accordance with the specifications and drawings.

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SECTION XVIII. INSTALLATION AND TESTING OF EQUIPMENT

18-01. Work included. - a. The contractor shall install all of the equipment furnished by him under the contract, and shall also install the following equipment to be furnished by the Government:

(1) Three 42-inch pumps.

(2) One 16-inch pump with electric motor.

(3) Three gasoline engines with mufflers and exhaust piping.

(4) Three right angle gear units.

(5) Intake and discharge piping and couplings and valves for all pumps, including discharge wall pipe for future pump unit.

b. The equipment to be furnished by the Government shall be installed under the supervision of a representative of the manufacturer. This supervision will be paid for by the Government.

18-02. Delivery. - a. The embedded castings for the pumps to be furnished by the Government will be available 100 days after notice to proceed; and the remainder of the equipment 180 days after notice to proceed. The contractor shall notify the contracting officer of the desired date of delivery (see Paragraph 1-14).

b. The contractor shall promptly unload the materials and equipment from railroad cars and trucks, and will be held responsible for any demurrage charges incurred due to failure to unload promptly the cars or trucks. The contractor shall transport the materials and equipment from the point of delivery to the site of the work and shall store them in a suitable warehouse until they are incorporated in the work. The cost of unloading, handling, hauling, storage, and caring for materials and equipment furnished by the Government shall be included in the contract price for Item 35.

c. The contractor shall check the quantity and condition of all materials and equipment when delivered to him and in case there is any damage to, or shortage of, material or equipment, he shall so report to the contracting officer, in writing, within 24 hours.

18-03. Packing and shipping. - All of the equipment that is to be furnished by the contractor and installed under the contract shall be adequately protected during shipment and shall be brought to the site of the work in good condition, free from damage, corrosion, or other defects. The apparatus shall be boxed, crated, or otherwise protected so as to prevent damage during shipment. Before shipment, all the apparatus shall be thoroughly cleaned, unfinished iron and steel surfaces shall be painted

as required in Section XIX, and all finished surfaces that might be subject to rust or corrosion prior to assembly shall be coated with a suitable, easily removable, rust-preventing compound (see Paragraph 1-13).

18-04. Installation. - The contractor shall install, erect, attach or build into the structures all the machinery, piping, and other metal work in a workmanlike manner as shown on the drawings or directed by the contracting officer. Wherever possible all parts shall be made accurately to standard gauge to facilitate replacement and repair. All work of the installation of the equipment shall follow the best modern practice in the installation of machinery of this type, notwithstanding any omission from these specifications. All work of installation shall be done by mechanics skilled in their various trades. The equipment shall be anchored to concrete foundations by means of steel anchor bolts. The anchor bolts shall be set at the time of placing the concrete foundations, by means of templates furnished by the equipment manufacturer. The concrete foundations for the equipment shall be constructed to the dimensions shown on the drawings or as recommended by the equipment manufacturer and shall be securely attached to the structural concrete floor slab by means of steel dowels. The equipment shall be given a touch-up coat of paint as required before the finish painting is done. (See Section XIX).

18-05. Pumps, gear units, discharge piping, gate valves, strainers and accessories. - Three 42-inch propeller pumps and one 16-inch volute type pump complete with electric motor, discharge piping, gate valves, strainers, anchor bolts and accessories shall be installed in the pumping station at the locations as shown on the drawings. The complete pumping unit shall be set accurately plumb and anchored to the concrete floor slab by means of anchor bolts. The wall section of each pump shall be grouted in after the pump is assembled. The anchor bolts shall be set at the time the concrete is poured by means of templates furnished by the pump manufacturer. The gate valves and horizontal discharge piping will be supported by suspension hangers as shown on the drawings. All discharge piping shall be securely anchored as shown on the drawings at the section extending through the pumping station wall.

18-06. Gasoline engines. - Three gasoline engines, with mufflers and exhaust piping, anchor bolts and accessories shall be installed in the pumping station at the locations shown on the drawings. The contractor shall furnish and install 2-inch asbestos covering with 8-ounce canvas jacket for exhaust pipe assembly insulation as shown on the drawings. The gasoline engines shall be set accurately and anchored to the floor slab by means of anchor bolts. The anchor bolts shall be set at the time the concrete is poured by means of templates furnished by the engine manufacturer.

18-07. Pipe fitting. - a. All pipe connections and joints shall be made tight and shall conform to local laws and regulations. Pipe threads shall be coated with Crane thread lubricant or equal so as to insure a tight joint. Sleeves for all pipes through floors and walls shall be standard weight, black wrought iron pipe conforming to Federal Specification

WW-P-441 for Wrought Iron Pipe. A lead joint shall be caulked between the pipe and the sleeve to form a watertight joint as shown on the drawings. Before any piping is covered up it shall be tested for leaks and made tight. The steam and water piping shall be tested by filling the systems with water and holding them for two hours under a pressure of 50 pounds per square inch for the steam piping and 150 pounds per square inch for the water piping. All piping tests shall be conducted as directed by the contracting officer and in the presence of his authorized representative.

b. In all runs of screwed piping, ground joint unions shall be inserted in every 30-foot run of pipe, at each item of equipment, and at such other places as is required to facilitate assembling and disassembling the piping.

18-08. Operation of equipment. - a. Equipment furnished by the contractor. - (1) After installation, all of the equipment and apparatus furnished and installed under the contract shall be placed in operation by the contractor and operated for a sufficient length of time and in such a manner as to satisfy the contracting officer that the equipment has been properly installed and that it meets all of the other requirements of the specifications. The contractor shall also perform such field tests as are required by the specifications and as may be directed by the contracting officer, relating to the following equipment:

Traveling crane (see Paragraph 16-08).

Heating and ventilating equipment (see Paragraph 13-08).

Sluice gates, complete with hoists (see Paragraph 12-13).

Lighting and power system (see Section XIV).

Gasoline-electric standby unit (see Paragraph 15-08).

Miscellaneous equipment (see Section XVII).

(2) In the event the operation or testing of equipment by the contractor discloses any defects or failure to comply with the specifications, the equipment shall be immediately shut down and said defect or failure shall be corrected by the contractor to the satisfaction of the contracting officer, and the equipment shall again be placed in operation. (See Paragraphs 1-37, 18-10 b, and 18-11 a.)

b. Equipment furnished by the Government. - After installation, all of the equipment furnished by the Government (see Paragraph 18-01 a), and installed under the contract shall be placed in operation by the contractor and operated for a sufficient length of time and in such a manner as to satisfy the contracting officer that the equipment has been properly installed. In the event the operation of the equipment by the contractor discloses any defect due to faulty or improper installation, the equipment shall be immediately shut down and said defect shall be corrected by the contractor to the satisfaction of the contracting officer. All field tests of this equipment will be conducted by the Government. (See Paragraphs 1-37, 18-10 and 18-11 b.)

18-09. Fuel and lubricants. - All fuel and lubricants necessary to place the equipment furnished under these specifications in operation and to perform the required field tests shall be furnished by the contractor. All oil reservoirs and grease containers shall be filled to their proper operating level. All fuel, lubricants, and other materials furnished by the contractor shall be those recommended by the manufacturer of the equipment in which it is to be used and shall meet the approval of the contracting officer. The Government will furnish all fuels and lubricants necessary to place in operation the equipment furnished by the Government.

18-10. Tests. - a. Installation. - Special care shall be exercised when aligning gear unit, electric motor, and pump shafts to insure free running in the bearings without binding. The shafts shall be turned by hand for at least 50 complete revolutions of the pump impeller. After the pump unit is completely installed it shall be given a thorough check for alignment and anchorage. The gate valves shall be opened and closed to insure free travel from the fully closed to the fully open positions. The check valve shall be swung open and shut without causing any undue binding.

b. Final operations. - After complete installation of pumping station equipment, the contractor shall operate the equipment for sufficient duration to ascertain that all equipment is in good running condition. Any changes or adjustments necessary to secure satisfactory operation shall be made by and at the expense of the contractor. Provided that if any part of the equipment is found to be defective due to no fault of the contractor as determined by the contracting officer, the contracting officer may order the contractor to correct such defects and payments therefor will be made to the contractor under the provisions of Article 3 of the contract.

18-11. Payment. - a. Equipment furnished by the contractor. - Payment for installing and testing the equipment and apparatus furnished by the contractor shall be included in the applicable contract prices. (See Sections X to XVII, inclusive.)

b. Equipment furnished by the Government. - Payment for installing the equipment furnished by the Government (see Paragraphs 1-14 and 18-01 a) will be made at the contract price for Item 35, and shall include the cost of unloading and hauling from the point of delivery, storing, handling, erecting, cleaning, placing, painting, testing and maintaining said equipment until final acceptance of the work by the contracting officer, and for furnishing and installing gasoline engine exhaust pipe insulation as specified. Payment will be made at the contract price for Item 35, "Installing Equipment Furnished by the Government."

c. Coordination of the work. - It is the intention of these specifications to provide for the construction of a complete and finished pumping station, ready for operation, and the prices named in the contract shall include all labor, equipment, materials, expenses, and costs which are not properly to be classified under any other item or items, and which may be necessary to perform the work to be done under said item in the manner herein set forth and specified. The contractor shall, without additional compensation therefor, coordinate and join together all of the various subdivisions of the work and complete the pumping station in accordance with the drawings and specifications.

SECTION XIX. PAINTING

19-01. Work included. - The contractor shall do all shop and field painting of equipment, and all other painting required at the pumping station, except that shop painting of equipment furnished by the Government as provided in Paragraph 1-14 will be done by others. All exposed iron and steel work not galvanized, all unfinished iron or steel parts of the equipment, all doors, door frames, and louvres, and the finished concrete surfaces of the engine-room floor and side walls shall be painted.

19-02. Paint materials. - a. All paint and paint materials shall conform, where applicable, to Federal Specifications of Group TT.

b. Priming coats for metal work shall be pure red lead paint, except that priming coats for standard manufactured articles and equipment may conform to the manufacturer's standard practice when approved by the contracting officer. Red lead paint shall be mixed in approximately the following proportions:

Paste red lead.....	100 lbs.
Raw linseed oil.....	1-7/8 gals.
Turpentine.....	2-1/2 pints (max.)
Drier.....	2-1/2 pints (max.)

c. Except as otherwise provided, finish painting above the engine-room floor shall be done with pure lead and oil paint of a composition and color approved by the contracting officer. With the exception of color pigments, the only pigments used in the paint shall be lead carbonate, zinc oxide, and titanium dioxide. No lithopone or fillers shall be used in the paint. Samples of all paint shall be submitted to the contracting officer for approval and selection.

19-03. Painting steel. - a. All ungalvanized structural and miscellaneous steel work not to be encased in concrete shall be given one shop coat and one field coat of red lead paint. After the shop fabrication has been completed and accepted, all material shall be cleaned of rust, loose scale, dirt, oil, grease, and other foreign substances, by wiping with gasoline or benzene, or by other approved means. After cleaning, the steel shall be given one shop coat of red lead paint. Surfaces which will not be accessible after assembly, but not in contact in riveted connections, shall be given a second shop coat.

b. After erection the steel shall be touched up by painting over all spots where the shop coat has been scratched, knocked off, or otherwise damaged. After touching up, the steel shall then be given a field coat of red lead paint. Either the shop coat or field coat shall contain a small amount of lamp black so that the field coat may be readily differentiated from the shop coat.

c. Steel above the engine-room floor shall be given one finish coat of approved paint (see Paragraph 19-02 c). Finish painting of steel below the engine-room floor shall be one coat of an asphalt paint similar and equal to "Anchor" asphalt paint manufactured by the Barrett Company of New York, and shall meet the requirements of Federal Specification TT-V-51, Type B, for Asphalt Varnish.

19-04. Painting equipment. - a. The equipment furnished by the Government will be painted by the equipment manufacturer. After installation, the contractor shall touch up all painted surfaces of equipment below the engine-room floor as found necessary by the contracting officer with the same type and color of paint as originally used by the manufacturer. Equipment above the engine-room floor shall be given one coat of approved paint (see Paragraph 19-02 c).

b. All unfinished iron and steel parts of the equipment furnished by the contractor shall be given one shop priming coat, one field touch-up priming coat, and two finish coats of approved paint (see Paragraph 19-02 c). The sluice gates and hoists shall be painted in accordance with the requirements of Paragraph 12-14.

19-05. Painting pipe. - All exposed, ungalvanized iron and steel pipe, valves, and fittings shall be given one shop priming coat, one field priming coat, and two finish coats of approved paint. The piping for the fire extinguisher equipment and circulating water system shall be painted with suitable identifying bands, as directed by the contracting officer and in accordance with local laws and regulations. Cast iron pipe and other pipe below the engine-room floor shall be finished with black asphalt paint as specified in Paragraph 19-03 c. Unless otherwise directed by the contracting officer, pipe insulation shall be sized and painted with two coats of an approved lead and oil paint.

19-06. Painting tanks and trash racks. - a. Those portions of the trash racks and trash rack hoists that are not encased in concrete shall be thoroughly cleaned and given one coat of red lead paint after installation. The finish painting shall consist of two coats of black graphite paint as specified in Paragraph 12-14 for sluice gates.

b. The gasoline and oil tanks shall be painted in the shop with one coat of red lead paint and two coats of black graphite paint as specified in Paragraph 12-14 for sluice gates. After installation any spots on the tanks where the paint has been damaged shall be touched up with graphite paint.

19-07. Painting concrete. - The concrete floor of the engine-room, the concrete machinery bases, and the walls below the brick masonry shall be painted with two coats of an approved lead and oil paint. Before painting, the concrete shall be thoroughly cleaned of all dirt, oil, grease, and other foreign material by scrubbing with soapsuds and flushing with clean, warm water. After washing, the concrete shall be treated with a weak solution of muriatic acid and again flushed with clean water. The concrete shall then be allowed to become thoroughly dry before painting. No paint shall be applied to concrete for at least 30 days after the concrete is placed.

19-08. Application of paint. - Paint may be applied by either brushing or spraying, provided satisfactory results are obtained. No paint shall be applied on damp or frosted surfaces and material painted under cover in damp or cold weather shall remain under cover until dry. Painting shall be done in a neat and workmanlike manner and all joints and crevices shall be thoroughly coated.

19-09. Payment. - No directed payment will be made to the contractor for painting, but all compensation desired therefor shall be included in the contract prices for the several contract items involved.

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SECTION XX. MISCELLANEOUS (Items 36 to 40 incl.)

20-01. Placing topsoil and sodding embankment slope (Items 36 and 37). - a. Work included. - The contractor shall furnish and place topsoil on the slopes of the earth dike as shown on the drawings, and on other areas as required by the contracting officer. The words "soil" or "topsoil" shall mean the material composing the surface layers of the ground containing varying amounts of organic matter. The finished embankment dimensions shall be as shown on the drawings. Under Item 36, acceptable topsoil shall be placed to the required depth of one foot over the required areas. Under Item 37, the prepared topsoil surface shall be sodded and seeded when and as directed by the contracting officer.

b. Placing topsoil. - After the earth dike has been completed to required height and dimensions, the contractor shall apply the stored topsoil (see Paragraph 4-01 b) or additional acceptable topsoil if necessary, to the specified depth when compacted, over the slopes of the embankment to the limits shown on the drawings. The topsoil shall be lightly rolled or tamped and any unevenness of surface shall be corrected to conform to finished grades.

c. Sodding. - (1) The slopes of the earth dike shall be planted by spot sodding with living sods of Bermuda or some other acceptable grass which will best meet the climatic conditions as approved by the contracting officer. Each sod shall have an area of not less than 16 square inches. Sods shall be placed not more than 18 inches center to center for the minimum-sized sods; larger sods may be spaced proportionately, depending on their size. Sods shall be covered with one-half to one inch of earth, in such manner as to protect the roots from drying out. Sods shall be placed as soon as practicable after cutting, and newly placed sods shall be kept moistened by sprinkling when and as required by the contracting officer for the entire period of the contract.

(2) Sodding shall be commenced immediately upon completion of the dike to final grade and cross section and shall be prosecuted at a rate satisfactory to the contracting officer. Seeding shall be done to supplement the sodding operations.

d. Seeding. - (1) Preparation. - All grass or cover crop seed shall be sown when directed by the contracting officer, so as to secure the greatest possible protection against erosion. The finished surface grade of the slopes shall be maintained in a true and even condition during the seed-sowing operation, and the contractor shall rake the soil to a depth of three-quarters of an inch (3/4") by using iron rakes immediately previous to sowing seed. All raking shall be done in a direction parallel to the contour lines on the slope and not uphill or downhill. All sticks, stones, weeds or trash appearing on the surface shall be removed.

(2) Seed mixture. - The following mixture will be approved for each acre of seeding:

Perennial Rye Grass	7 lbs.
Orchard Grass	15 lbs.
Hard Fescue	4 lbs.
Kentucky Blue	6 lbs.
Sheep Fescue	6 lbs.
Timothy	7 lbs.
Perennial Red Clover	4 lbs.
White Clover	4 lbs.
Red Top	7 lbs.
Total per acre	60 lbs.

For all seeded areas, about 15 pounds of oats per acre shall be added if the planting is done between the middle of June and the middle of September, and about 15 pounds of winter rye per acre shall be added if the planting is permitted and done in the late season after the middle of September.

(3) Method of seeding. - The contractor shall take advantage of favorable weather and shall employ a method of sowing satisfactory to the contracting officer. The seed shall be raked in and the whole surface then lightly rolled. Seeding shall be done immediately after the preparation of the earth surface and completion of sodding operations unless otherwise directed. If there be any delay, and if weeds grow in and with the grass, such weeds shall be cut before they go to seed or at such time as directed by the contracting officer. If any loam is washed away or any portions of the seeded areas are not covered by grass, the contractor shall replace the topsoil, fertilize and re-seed.

(4) Maintenance. - The contractor shall maintain the areas sown to grass seed on each section of the project, until all work on the entire contract has been completed and accepted by the contracting officer. This maintenance shall consist of occasional mowing with a scythe or mechanical mower, watering during periods of drought, and removal of conspicuous weeds, or any other similar operations whenever required by the contracting officer. The turf areas shall be fertilized with an acceptable commercial lawn fertilizer of a quality equal to Vigoro or Scott's lawn fertilizer at the customary quantity per acre recommended by the manufacturer.

e. Measurement and payment. - (1) The quantity of topsoil to be paid for under Item 36 will be the number of cubic yards actually placed in accordance with directions, measured after compacting, whether obtained from stock-piles or from other sources at the expense of the contractor. Payment shall include the costs of all labor, materials and expenses incidental to furnishing and placing the topsoil. Payment will be made at the contract unit price, Item 36, "Topsoil."

(2) The quantity to be paid for under Item 37 will be the number of acres sodded and seeded as directed. The measurement will be actual superficial areas sodded and seeded. Payment shall include all costs for sodding and seeding as specified in subparagraphs c and d above, and for all materials and expenses incidental thereto. Payment will be made at the contract unit price, Item 37, "Sodding and Seeding."

20-02. Surfacing for top of dike (Item 38). - a. Work included. - The contractor shall furnish and place gravel, or crushed stone if approved by the contracting officer, of the sizes and quality specified or directed for the surfacing of the top of the dike and for roads, as shown on the drawings or as directed by the contracting officer.

b. Material. - The gravel or crushed stone shall be composed of hard, durable stones, free from thin or elongated pieces. The gravel or crushed stone shall be of such sizes that all will pass through a screen with 3/4-inch square openings, and not less than 35 percent will be retained on a screen with 1/4-inch square openings, and shall be uniformly graded. The finer material shall consist of sand or other suitable binding material encountered in bankrun gravel and approved by the contracting officer. Should the material as received for the work fail to maintain suitable proportions of coarse and fine particles, or should the coarse particles not be uniformly graded between the maximum and minimum sizes as specified, it shall be screened or mixed in such a manner as to furnish a material to meet the above requirements.

c. Placing. - (1) The surfacing shall be placed in one layer, and shall be 6 inches thick after compaction. After the subgrade or foundation shall have been prepared and compacted properly and proper drainage provided, the surfacing shall be spread evenly by means of approved spreader vehicles or trucks. The material as spread shall be well-graded with no pockets of fine material or segregation of large and fine particles. After being spread evenly, the material shall be graded and compacted to the required thickness by rolling with a self-propelled three-wheel roller weighing not less than ten tons, until a firm even surface is obtained. If at any time the material does not contain a sufficient amount of moisture to insure proper binding of the material, water shall be added by means of a sprinkling wagon or any approved method in a sufficient amount to obtain the desired results.

(2) Compacting of the material shall start longitudinally at the side and gradually proceed toward the center of the roadway so far as practicable, overlapping on successive trips. During the process of compacting, the material shall be dragged; the dragging and compacting shall continue until the surfacing does not creep or wave under the roller.

d. Shoulders. - Shoulders shall be constructed as shown on the drawings and carefully maintained. Before the completion of the work the shoulders shall be reformed, trimmed, and dressed as required by the contracting officer.

e. Measurement and payment. - The quantity to be paid for under Item 38 will be the number of cubic yards of surfacing furnished in accordance with directions within the limits designated, measured in place after compacting. Payment will be made at the contract unit price, Item 38, "Surfacing for Top of Dike."

20-03. Manholes (Item 39). - a. Work included. - The contractor shall construct the manholes at the points indicated on the drawings, or as directed by the contracting officer.

b. Description. - (1) The manholes shall be built of brick masonry with concrete bases and brick inverts. They shall conform in shape, size, dimensions and in other respects to the details indicated on the drawings. Excavation for the manholes shall comply with the provisions of Paragraph 4-03, as far as they are applicable.

(2) The contractor shall furnish all the materials required for the construction of the manholes including brick, cement, sand, hydrated lime, waterproofing compound, concrete, castings, steps, and all other materials required. The concrete for manhole bases shall comply with the applicable provisions of Section VIII.

c. Brick masonry. - (1) Kind of brick. - The brick shall be good, sound, hard and uniformly burned brick, regular and uniform in shape and size, of compact texture and satisfactory to the contracting officer. Brick shall comply with Federal Specification SS-B-691, Grade B, standard size 2-1/4 by 3-3/4 by 8 inches. In case the contracting officer rejects any brick the same shall be immediately removed from the work and brick satisfactory to the contracting officer substituted. Brick shall be culled and compactly piled as soon as delivered.

(2) Mortar for brickwork. - The mortar shall be composed of one part Portland cement and 2-1/2 parts sand, to which approximately 20 pounds of hydrated lime shall be added for each sack of cement. All mortar used shall be thoroughly mixed either by hand or in a mechanical batch mixer. Mortar shall be prepared in such quantities that it can be used entirely before it has attained its initial set. The minimum amount of water sufficient to make a workable mortar shall be used. Cement and sand used in mortar shall meet the requirements of Paragraphs 8-05 and 8-06. The hydrated lime shall be of approved commercial quality suitable for the use intended.

(3) Brick laying. - The bricks shall be clean and shall be thoroughly wetted shortly before they are put into the wall and each brick shall be laid in a full bed and joint of mortar, without requiring subsequent grouting, flushing or filling, and shall be

thoroughly bonded as directed. Brickwork shall be satisfactorily protected against weather and frost until the mortar has set.

(4) Plastering. - Outside faces of brick masonry shall be plastered with Portland cement mortar. The thickness of the cement mortar plaster shall be from 1/4-inch to 3/8-inch and the mortar shall be carefully spread and thoroughly troweled, leaving a smooth exterior surface.

d. Iron castings. - (1) Quality of cast iron. - Cast iron manhole frames, covers and steps shall be as detailed on the drawings. The manhole covers and frame seats shall be machined to true plane surfaces. The castings shall be good quality, strong, tough, even grained cast iron, smooth, free from scale, lumps, blisters, sand holes and defects of every nature which would render them unfit for the service for which they are intended. All castings shall be thoroughly cleaned and subject to careful hammer inspection. The manhole covers shall be standard, and capable of sustaining a concentrated load of 300 pounds at the center. Castings shall conform at least to the provisions of Paragraph 11-02 a (8).

(2) Installation. - Cast iron steps and manhole covers and frames shall be installed as shown on the drawings.

(3) Painting castings. - New castings before being shipped from the foundry shall be given one coat of coal tar pitch varnish applied in a satisfactory manner as to make a smooth coating, tough, tenacious and not brittle or with any tendency to scale off.

e. Payment. - (1) The contract unit price for Item 39, "Manholes", shall include all costs for furnishing the materials, equipment, and labor required to construct the manhole to the lines and grades shown on the drawings, together with plastering of outside faces as described in Paragraph 20-03 c(4), except the cost of excavation and backfilling, the concrete base and the metal work.

(2) Payment for excavation will be at the contract unit price for Item 3 (see Paragraph 4-03 f). Payment for backfilling will be made at the contract unit price for Item 10 (see Paragraph 6-03 d). Payment for concrete will be made at the contract unit price for Item 16 (see Paragraph 9-01 and 9-03). Payment for manhole frames, covers, and steps will be made at the contract unit price for Item 19 (see Paragraph 11-04).

20-04. Vitrified clay pipe (Item 40). - a. Work included. - The contractor shall furnish and lay tile pipe, including specials, of the required diameter for connecting to the pumping station downspout drains at the locations shown on the drawings or as directed. The contractor shall connect the 8-inch tile drain to the 36-inch reinforced concrete pipe where shown on the drawings.

b. Materials. - All pipes shall be bell-and-spigot, vitrified, clay pipe, conforming to the requirements of Federal Specification SS-P-361, or subsequent amendments or revisions thereof. Each pipe shall be carefully inspected immediately before laying and no cracked, broken or otherwise imperfect pipe shall be used, except for minor defects which, in the opinion of the contracting officer, do not impair the fitness of the pipe for the purpose intended.

c. Laying pipe. - Proper care shall be used in handling the pipe to avoid injury or breakage. The pipe shall be carefully bedded on compacted backfill, and properly connected and jointed. Bell holes shall be bedded to insure that each pipe shall rest firmly upon its bed for the entire pipe length. The pipe shall be laid true to the lines and grades shown on the drawings or as staked in the field. Joints shall be made with cement mortar composed of one part Portland cement and 2-1/2 parts sand. All mortar used shall be thoroughly mixed either by hand or in a mechanical batch mixer. Mortar shall be prepared in such quantities that it can be used entirely before it has attained its initial set. The minimum amount of water sufficient to make a workable mortar shall be used. Cement and sand used in mortar shall meet the requirements of Paragraphs 8-05 and 8-06. The spigots shall be centered in the bells, and there shall be no shoulders or unevenness of any kind along the invert of the pipes. Special care shall be taken that the joint space be of equal width around the pipe, making use of jute or oakum gaskets soaked in cement grout to center the pipe. The mortar shall be thoroughly troweled into the joint, and a sufficient overfill shall be made to hold the mortar in the joint firmly in place. The interior of the pipe shall be carefully cleaned after laying to remove dirt, mortar and other obstructions.

d. Backfilling. - Backfill material shall be evenly spread and compacted under and around the pipe. Backfill over the pipe shall be done in accordance with the provisions of Paragraph 6-02, unless otherwise shown on the drawings or directed by the contracting officer.

e. Payment. - (1) Payment for pipe will be made at the contract price for Item 40, "Vitrified Clay Pipe", for the various sizes installed and shall include all costs of furnishing and installing the pipe including specials and other required materials, except the cost of backfilling.

(2) Payment for backfill will be made at the contract unit price for Item 9 (see Paragraph 6-02 d).

20-05. Cleaning up. - a. Work included. - The contractor shall remove all construction equipment and all temporary structures built or used by him, shall remove rubbish of all kinds from the site of the work, and from any grounds which he shall have occupied within the

limits of the work, and shall leave the site of the work in a clean condition satisfactory to the contracting officer. All materials salvaged shall be the property of the contractor.

b. Payment. - For all work, materials and incidentals required to clean up as set forth in a above, the contractor will receive no direct payment, but payment shall be considered as having been included in the contract prices for Items 1 to 40 inclusive.

U. S. ENGINEER OFFICE
PROVIDENCE, RHODE ISLAND

Invitation No. 699-40-323

STANDARD GOVERNMENT FORM OF BID

(Construction Contract)

(Place) _____

(Date) _____

The District Engineer,
U. S. Engineer Office,
Room 819, Industrial Trust Bldg.,
Providence, Rhode Island.

In compliance with your invitation for bids dated May 7, 1940, and subject to all the conditions thereof, the undersigned

_____

a corporation organized and existing under the laws of the State of _____, a partnership consisting of _____

_____

_____

_____

or an individual trading as _____

_____

_____

of the City of _____ hereby proposes to furnish all plant, labor, and materials, except the equipment and materials specified in Paragraph 1-14 and Section XVIII of the specifications, and perform all work required for the construction of Jones Ferry Pumping Station and appurtenant structures on the Connecticut River in Chicopee, Massachusetts, including all work indicated on the drawings, or required by the specifications, and such incidental work as needed or ordered in

writing by the contracting officer, in strict accordance with the specifications, schedules, and drawings, for the consideration of the following prices:

Item No.	Designation	Unit	Quantity	Unit Price	Amount
1	Preparation of Site	acre	0.54		
2	Control of Water and Sewage	job	-		
3	Common Excavation - General	cu.yd.	11,500		
4	Removal of Concrete Headwall	job	-		
5	Removal and Replacement of Existing Sewers and Drains	"	-		
6	Impervious Fill	cu.yd.	890		
7	Pervious and Random Fill	" "	2,945		
8	Gravel Bedding	" "	14		
9	Semi-Compacted Backfill	" "	3,925		
10	Compacted Backfill	" "	312		
11	Riprap - Hand Placed	" "	27		
12	36-Inch Reinforced Concrete Pipe	lin.ft.	25		
13	24-Inch Reinforced Concrete Pipe	" "	122		
14	Cement	bbl.	1,817		
15	Concrete - Class "A"	cu.yd.	1,215		
16	Concrete - Class "B"	" "	298		
17	Steel Reinforcement	lb.	151,300		
18	Pumping Station Superstructure	job	-		
19	Miscellaneous Iron and Steel	lb.	22,981		

Item No.	Designation	Unit	Quantity	Unit Price	Amount
20	Miscellaneous Pipe and Fittings	lb.	1,566		
21	Copper Water Stops	"	357		
22	Steel Trash Racks	job	-		
23	Sluice Gates, Complete with Hoists	"	-		
24	Heating and Ventilating Equipment	job	-		
25	Lighting and Power System	"	-		
26	Gasoline-Electric Standby Unit	"	-		
27	Traveling Crane, Complete	"	-		
28	Sump Pump	"	-		
29	Water Supply and Plumbing Fixtures	"	-		
30	Carbon Dioxide Fire Extinguishing Equipment	"	-		
31	Emergency Water Supply System	"	-		
32	Drains	"	-		
33	Gasoline Tank and Piping	"	-		
34	Float Gage	"	-		
35	Installing Equipment Furnished by the Government	"	-		
36	Topsoil	cu.yd.	235		
37	Sodding and Seeding	acre	0.24		
38	Surfacing for Top of Dike	cu.yd.	36		
39	Manholes	each	2		
40	Vitrified Clay Pipe	job	-		
TOTAL					

Note: All amounts and totals given above will be subject to verification by the Government. In case of variation between unit bid price and totals shown by bidder, the unit price will be considered to be his bid.

PLANT TO BE USED ON THE WORK

(See Invitation for Bids and Paragraph 1-09 of the specifications)

Note: - Use separate line for each major item.

No.	Name	Kind	Capacity	Age and condition

Material Handling Equipment

Pumping Equipment

Earth Embankment Equipment - Rolled Fill
(Excavation and Transportation)

(Spreading and Rolling)

Rock Fill and Riprap Equipment

Gates and Accessories, Machinery
(The bidder shall submit catalogues and information showing all details of permanent equipment he proposes to install.)

Concreting Equipment

Miscellaneous Equipment

EXPERIENCE. - (See Invitation for Bids)

DATA SHEETS

The bidder shall submit with his proposal the following information regarding the equipment he proposes to furnish. Statements so made by the bidder are intended to be, and are, express warranties.

DATA SHEET

TRAVELING CRANE

Manufacturer's name _____

Capacity _____ tons

DATA SHEET

SLUICE GATES

1. Gates:

   Manufacturer _____

2. Hoists:

   a. Manufacturer's name _____

   b. Model or type _____

   c. Hoisting speed _____

3. Electric motors:

   a. Manufacturer's name _____

   b. Type and rating _____

DATA SHEET

93.8 KVA GASOLINE-ELECTRIC GENERATOR UNIT

1. Engine: (Manufacturer) _____

   Number Cylinders _____

   Bore and Stroke _____

   Piston Speed at Rated Output _____

   Lbs. Fuel per kw-hr. at 125% Rated Output of Generator _____

   Lbs. Fuel per kw-hr. at 75% Rated Output of Generator _____

   Battery (Make and Capacity) _____

   Governor (Make and Type) _____

   Net Weights: Engine _____ Pounds

   Generator and Exciter _____ Pounds

   Complete Unit, including Common Base _____ Pounds

2. Electric Generator: (Manufacturer) _____

   Rating: _____

   Efficiency, at 80% lagging power factor, as determined in accordance with American Institute of Electrical Engineers standardization rules, will not be less than the following:

   Full load ____%; 3/4 load ____%; 1/2 load ____%.

DATA SHEET

ELECTRIC SWITCHBOARD

Manufacturer _____

Overall Dimensions _____

DATA SHEET

SUMP PUMP

1. Pump:

   a. Manufacturer's name _____

   b. Model or type _____

   c. Capacity at 35-foot head at rated speed _____

   d. Shut-off head _____

   e. Pipe size of discharge connection _____

2. Electric Motor:

   a. Manufacturer's name _____

   b. Type and rating _____

DATA SHEET

EMERGENCY WATER SUPPLY PUMP

1. Pump:

   a. Manufacturer's name _____

   b. Model or type _____

   c. Capacity at rated speed against ____ foot-head _____

   d. Shut-off head _____

   e. Pipe size suction connection _____

   f. Pipe size discharge connection _____

It is hereby warranted that in the event award is made to the undersigned there will be used in the performance of the work covered by the contract only such unmanufactured articles, materials and supplies as have been mined or produced in the United States and only such manufactured articles, materials, and supplies as have been manufactured in the United States all from articles, materials, or supplies mined, produced or manufactured, as the case may be, in the United States, except as noted below or otherwise indicated in this bid or authorized in the specifications.

The undersigned agrees, upon receipt of written notice of the acceptance of this bid within 60 days after the date of opening of the bids, to execute the standard form of Government contract, in accordance with the bid as accepted, and to give the required bonds with good and sufficient surety or sureties for the faithful performance of the contract and for the protection of all persons supplying labor and materials in the prosecution of the work, within 10 days after the prescribed forms are presented for signature.

Performance will begin within 10 calendar days after the receipt of notice to proceed and will be completed within 250 calendar days after date of receipt of said notice to proceed.

_____
(Bidder)

_____
(Address)

By _____
(Name) (Title)

NOTE: - Read Standard Government Instructions to Bidders before preparing this bid.